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HIS LATE HIGHNESS MAHARAJA SRI KRISHNARAJA WADIYAR BAHADUR, G.C.S.I., G.B.E.

(4th June 1884—3rd August 1940)

WITHIN a short period of less than five months, the Royal Family of Mysore and the people of the State have sustained two grievous losses. By the death of His Highness Maharaja Krishnaraja Wadiyar Bahadur, the British Empire has lost a loyal friend; India, a remarkable personality; the Princes, a great exemplar of their Order; Mysore, a wise, sagacious and patriotic ruler; the Royal Family, a gracious protector. It may well be that when we look back on that noble life of devoted service to the State, and of the perpetual triumph of the soul over the trials, which an unkind fate had brought upon it, that, late in the evening of that fatal Saturday, some may have heard the faint echoes of the trumpets sounding the retreat for him. It was now between nine and ten in the night. The Maharaja closed his eyes. A noble end terminated a noble career. There were assembled about him his relations, for whom he cherished affection; friends of his youth, who had been true to him; officers who had served him with fidelity. A star of the first magnitude has gone from the world of princes, leaving an after glow in its place.

It will be remembered that Mahatma Gandhi, an incisive and acute critic of the Princely rank, once characterized the administration of the late Maharaja of Mysore as "RAMA RAJYA". The Mahatma scarcely indulges in rhetoric or flattery, and never palters with truth. While there can be nothing more remarkable than the accuracy of this critical and unbiased estimate, it must be borne in mind that one of the keys to the life of His late Highness was that his roots had struck deep into the ideals of the saintly and philosophic rulers of ancient Puranic India, and that it was

from this source that he drew his inspiration and strength. Convinced that the guardianship of the destinies of his people had been entrusted to his care by Almighty, His late Highness, while discharging the responsible duties attached to his high station, sought for His approbation by silently and unostentatiously building for himself a strong and enduring place in the hearts of his people. To the long succession of generations yet unborn in Mysore, the name and example of one of the greatest rulers in modern India, whose reign has just ended, will be as much a source of inspiration, as they have been held in reverence by those to whom the loss is still fresh. When History focuses her hard light upon the life and character of Maharaja Krishnaraja Wadiyar Bahadur, and upon the many notable achievements of his long and eventful reign, covering a period of thirty-eight years, during one of the most critical phases of the political development of India, she will remember the name of this great prince with the other illustrious rulers of the lunar race.

At an age when young men are still pursuing their studies in schools and colleges, His late Highness was summoned to assume the governance of a State, larger than most of the independent principalities of Europe, and he brought to bear on his office a rare combination of gifts,—not common among men of maturer experience,—gifts, with which nature had endowed him in profusion, such as wisdom, sagacity, judgment and statesmanship. Before he was ten years old, Providence had deprived him of watchful paternal guidance, which naturally passed to the wardenship of the Regent Maharani. The Prince's early education took the form of a silent process of implanting into his mind the principles of religion and virtuous conduct; and the officially appointed tutors trained him in all branches of learning, and in the theory and practice of administration. Ceaseless study from early years, intercourse with eminent men and extensive travels had greatly enriched his natural abilities and it is therefore little wonder that he was able to enter upon the arduous duties of his office, when at the age of eighteen, he ascended the throne of his predecessors. His late Highness was generally supposed to have been reticent and reserved, which, however, did not prevent him from unbending.

He was a competent exponent of all branches of fine arts, and recognised and rewarded merit in others. Possessing an excellent physical constitution, he patronised and participated in every form of manly exercise and sport. Being of a philosophical turn of mind, he was an ardent scholar of Indian and Western metaphysical classics. Always devout, His late Highness observed the usages of the ancient Hindu religion in all the festivities and ceremonies, annually celebrated in his court. He had a generous tolerance towards the customs and practices of the diverse religious creeds of his numerous subjects. Though by natural aptitude, his mind was moulded in the pattern of ancient Hindu culture, His late Highness was greatly alert in assimilating the progressive spirit of all that was best in the Western science, literature and politics. In all his public speeches are discernible the marks of his wide and varied learning, and of a powerful and balanced mind, devoted to constant enquiry and to the sifting of values. As his gifts were rich and his interests, exceptionally wide and varied, so it is that the death of this eminent ruler must necessarily leave many gaps in the public life of this country.

The high political prestige which Mysore enjoys to-day is due to the progressive policy adopted by His late Highness and his gifted Dewans. When he ascended the throne in 1902, he found that, under the late Sri Chamaraja Wadiyar Bahadur and later of the Regent Maharani, the

State had already attained a high degree of administrative efficiency, under the stewardship of Rangacharlu and Seshadri Iyer, who laid the foundation of the political and economic structure of the State. Dewan Rangacharlu instituted the Representative Assembly which introduced a popular element in the administration. Dewan Seshadri Iyer is gratefully remembered for his bold policy of inaugurating great schemes of public utility, which gave a definite impetus to the economic advancement of the State and its people. In the year 1907, the Legislative Council was established, which marked a further forward step in associating the elected representatives of the people with the Government. Between the years 1909 and 1919, during which Sir M. Visvesvaraya was associated with the State, first as Chief Engineer and later as Dewan, public life was galvanized into an unprecedented activity in every sphere. His period of office marked a distinct turning point in the economic and industrial development of Mysore, which inspired new ideals in public life, and gave a fresh outlook to the aspirations of the people. Like his brilliant predecessor Sir K. Seshadri Iyer, he was exacting towards others collaborating with him, and he demanded a very high standard of efficiency, but he was not nearly so exacting towards others as he was towards himself. The second stage in the history of Mysore began when Sir Mirza M. Ismail became Dewan. The commencement of his regime was characterized by an immediate manifestation of energy in the various departments of the State, and it was apparent that a period of rapid reforms and progress had been inaugurated. His sobriety, self-command, soundness of judgment, perfect rectitude of intention and patriotic devotion to the ruler and unremitting zeal in the promotion of the best interests of the State have won for him popularity and reputation both in the State and abroad. The achievements with which his name is associated cover an extensive ground;—in the field of public health administration, the campaign he has initiated for the alleviation of human suffering; in the region of rural reconstruction, the measures adopted for the economic regeneration of the poor villagers; in the realm of industry and engineering projects of great public beneficence, the institution of numerous works for utilising the material resources of the State and in the domain of cultural, political and æsthetic development of public life, the bold and enterprising schemes undertaken and executed;—these and others constitute a notable record in the administrative annals which furnish few parallels even in British India.

The rule of His late Highness Sri Krishnaraja Wadiyar Bahadur, forms a towering peak on the map of Mysore. He was the architect of modern Mysore. He brought his subjects material prosperity and security, which fact alone is justification enough for placing His late Highness among the galaxy of the great Indian rulers. The mantle of the illustrious uncle has descended to the equally great nephew. The ministers who served His late Highness devoutly and loyally, stand by the young Maharaja with the same steadfastness and fidelity. The people, who cherished veneration for the late Maharaja, own deep devotion to His Highness Maharaja Sri Jaya Chamaraja Wadiyar Bahadur. They anticipate that the new rule, which has commenced, will witness increasing prosperity in the State, and they hope and pray for peace, happiness and glory for the young Maharaja and the Royal Family.

PYRETHRUM CULTIVATION IN KASHMIR

BY

M. R. FOTIDAR

(*Department of Agriculture, Srinagar*)

PYRETHRUM constitutes a genus of *Chrysanthemum* in Compositæ family and is said to constitute a hundred species, out of which a few are toxic to insects. The principle specie, commercially important, is *Pyrethrum cinerariæfolium*. The plant ordinarily resembles the field daisy, particularly the flower which is apparently similar to the daisy in size, shape and colour. The plant is perennial and grows 18 to 20 inches high. Stems are unbranched and slightly hairy. Leaves are petiolate and finely cut. The flower heads consist of rounded receptacles, a straw coloured involucre composed of three rows of scales and a disc containing numerous yellow flowers with a circle of yellow or cream coloured ray flowers. The ray florets are ligulate, pistillate with cream or white coloured corolla. These florets are delicately veined and exhibit three teeth at the tip. The disc florets are yellow, tubular, perfect and have five lobed corolla borne on the achene. The flowers vary from 6 to 24 mm. in diameter.

The dried crushed flowers have a pleasant, characteristic odour due to the presence of essential oil which is pronounced in the freshly prepared material. It has acrid, bitter taste and causes numbing sensation to the tongue and lips, which is due to the active principal present in the plant. The active principal is called pyrethrin, which is said to exist in two forms. Both these forms are mineral oil soluble.

The use of pyrethrum flowers in powdered form and its extraction is known since earlier days. At present very large quantities of the flowers are utilised in U.S.A. and other Occidental countries.

The plant is cultivated on a commercial scale in Dalmatia (Yugoslavia), Japan, Kenya, some parts of Italy, United Kingdom and Russia. Japan and Kenya are the two principal producing countries.

Since last several years the use of this insecticide has been found practicable as a control against mosquitoes. The adults readily succumb when the pyrethrum extract is sprayed on them, as is evident by the so-called commercial 'Flit'. Flit is a mineral oil extract of Pyrethrum.

India has been importing flowers from Kenya in considerable quantities.

The Imperial Council of Agricultural Research having recognised the possibilities of its local demand, took necessary steps for the introduction of pyrethrum cultivation in India. Seeds in small quantities were imported and distributed to various provinces and the constituent States in the year 1937.

The Department of Agriculture started its cultivation under the auspices of The Imperial Council of Agricultural Research. This is the third year of the plantation. From the present harvest which has been just completed we have more than half a maund of seed, besides some quantity of dried flowers for experimentation. The last two years' experiments have shown:—

1. Seeds sown in well-prepared nursery beds in spring, early summer and autumn germinated well, although the early summer percentage was 50 per cent. less than that of spring and autumn.

2. From 1 lb. of seed we obtained about 15,000 seedlings.

3. The seedlings were transplanted after 4 or 5 weeks, one and a half foot apart either way. Seedlings can be planted both in spring and autumn.

4. Very little irrigation is needed. In fact too much irrigation or plenty of rain damages the plant.

5. The crop could be multiplied by subdividing the one year or two year old plants, and the area as such could easily be multiplied 4 to 6 times.

6. The flowers are ready for harvesting in the beginning of June. The flowers ripen for seed production sometimes in the middle of July.

7. In the first year of plantation, very few flower heads are produced, second and third year gives increased yields. In the second year we obtained as much as 300 lb.

of flowers per acre, and some of the individual bushes did yield 500 flower heads.

8. The flowers were sent for trial purposes to The Malarial Institute of India, who have found the specimen equivalent to the Kenya ones in biological test. It is said to have contained about 1 per cent. pyrethrin.

9. The vitality of the seed has not been affected by storage for one complete year so far.

Other cultural experiments including manuring under irrigated and unirrigated conditions in different classes of soils have been started at about a dozen centres. It is expected that the cultivation of pyrethrum will be started on a very large scale during the coming season.

The Forest Department had taken up the cultivation earlier and this year they have brought an area of about 200 acres under this crop.

Small samples of five other varieties namely *P. roseum; P. parthenium; P. cineraria; P. carneum; P. lencopiloides* have also been received from The Imperial Council of Agricultural Research. Out of these only two, *i.e., Pyrethrum roseum* and *Pyrethrum parthenium,* succeeded well. As a plant, none of these can compare well with *Pyrethrum cinerariæfolium.* Samples of flowers are collected and will be sent for biological test.

OBITUARY

THE HON'BLE SIR ALFRED GIBBS BOURNE, K.C.I.E., D.Sc., F.R.S., F.L.S.
(1859–1940)

MANY of the old students of Sir Alfred Bourne will doubtless grieve to hear of the sad news that he passed away. He was comparatively young when, in 1886, he arrived in Madras to join the Presidency College as Professor of Biology which he held till 1898. During this period, however, he acted on several occasions as Registrar of the Madras University and as Superintendent, Government Museum. On relinquishing the professorial chair in 1903 he was made Director of Public Instruction and Commissioner for Government Examinations, with provision for a seat in the Legislative Council. He retired from this office in 1914.

Sir Alfred Bourne established a great reputation both as a teacher and as an investigator. Before he landed in India, he had published important memoirs on zoological subjects and his brilliant work in India enabled him at an early age to be elected into the Royal Society. His many students will remember that though he was a man of few words there beat within him a true human heart, and in the spirit of a loving teacher he exerted his influence to advance their interests. In his capacity as Director of Public Instruction his constant endeavour had been to expand secondary education to which modern sides were added. He introduced the Secondary School Leaving Certificate system. As Chairman of the first university inspecting commission his report is a document of great importance and lucidity and some of the recent reforms in the university education can be traced to his labours.

After retiring he was summoned to assume charge of the Indian Institute of Science as its Director, which post he held with conspicuous distinction from October 1915 to March 1921.

Sir Alfred Bourne may not have come into personal contact with a very large body of students in South India. But nevertheless, the few that came under his direct influence will remember the many excellent qualities of that brilliant scientist who commanded a raging popularity and widespread esteem. His name and work in Madras will be remembered for a long time in grateful appreciation.

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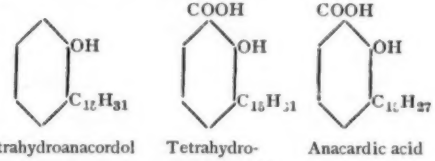
The Constitution of Anacardic Acid, the Principal Constituent of Cashew-Nut Shell Oil

CASHEW-NUT shell oil from the pericarp of the seed of cashew-nut tree—*Anacardium occidental*—is an article of great commercial value. A small part of the oil produced in India is used locally as a preservative coating for country boats, wooden floors, and fishing nets, major portion being exported to America for the manufacture of insulating varnishes, lubricating oils, synthetic resins, etc.

Stadeler[1] who first studied the chemical composition of this oil, separated the acid constituent called "Anacardic Acid" and the neutral one, "Cordol". Ruheman and Skinner[2] later established the correct molecular formulæ of anacardic acid as $C_{22}H_{32}O_3$. Smit[3] suggested that anacardic acid is a penta-deca-dienyl-salycylic acid $C_6H_4.OH.COOH.C_{15}H_{27}$. On catalytic hydrogenation of anacardic acid he obtained tetrahydroanacardic acid from which by decarboxylation, tetrahydroanacordol was obtained. The presence of a hydroxyl group and a pentadecyl side chain was established by him, but the ortho-position of the pentadecyl side chain to the hydroxyl group was suggested by him by mere analogy with pelandjauic acid.[4] According to him, therefore, the following are the structures of tetrahydroanacordol, tetrahydroanacardic acid and anacardic acid.



Tetrahydroanacordol — Tetrahydroanacardic acid — Anacardic acid

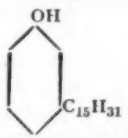
Later P. P. Pillay[5] also studied the constitution of anacardic acid and obtained results similar to those of Smit's. Further he claims to have isolated salicylic acid as a product of potash fusion of phenol obtained by destructive distillation of anacardic acid and hence he has also assigned the alkyl chain an ortho-position to hydroxyl group. This evidence appears to be of doubtful nature as under the drastic

conditions employed, the possibility of intramolecular changes cannot be overlooked. The authors in order to get conclusive evidence on this point have now synthesised *o*-pentadecyl phenol which according to Smit and Pillay[6] should be tetrahydroanacordol.

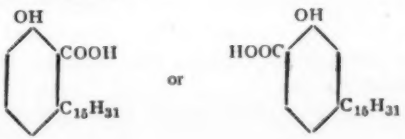
By Fries transformation of phenyl-pentadecylate are obtained *o*-hydroxy-pentadecaphenone and *p*-hydroxy-pentadecaphenone which on reduction by Clemmensen's method give *o*-pentadecyl-phenol and *p*-pentadecyl-phenol. Although *o*-pentadecyl-phenol (m.p. 54°–55° C.) and tetrahydroanacordol (m.p. 53°–54° C.) have very similar melting points, they are quite different in nature and chemical properties and by direct comparison of the two and their corresponding three derivatives, they are proved to be unidentical. Further tetrahydroanacordol (m.p. 53°–54° C.) is found to be not identical also with *p*-pentadecyl-phenol (m.p. 72·5° C.).

As the presence of a hydroxyl group and a pentadecyl side chain in tetrahydroanacordol has been definitely established by both Smit and Pillay[7] the only structure that can possibly be given to it is that of *m*-pentadecyl-phenol. This conclusion is experimentally supported by the fact that like *m*-alkyl phenols, tetrahydroanacordol forms a tribromo derivative while ortho and *p*-pentadecyl phenols form dibromo derivatives.

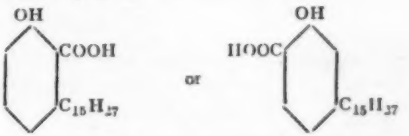
This conclusion is finally established by the oxidation experiments on methyl ether of anacordol which led to *m*-methoxy-benzoic acid. This finally establishes the constitution of tetrahydroanacordol to be *m*-pentadecyl phenol.



The possible structures of tetrahydroanacardic acid are therefore:



and the corresponding possible structures of anacardic acid are:



G. D. Gokhale.
M. S. Patel.
R. C. Shah.

The Royal Institute of Science,
Bombay,
June 27, 1940.

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[1] *Das Annelen der chemie und der pharmacie*, 1847, **63**, 137.

[2] *J.C.S.*, 1887, T. **663**.

[3] *Proceedings K. Akad. Wetenschappen*, Amsterdam, 1931, **34**, 165.

[4] P. Van Romburgh, A. G. Van Veen and A. G. H. Smit, *Proc. Akad. Sci.*, Amsterdam, 1930, **33**, 589–94.

[5] *J. Ind. Chem. Soc.*, 1935, 226.

[6] *Loc. cit.*

[7] *Loc. cit.*

Changes of Atmospheric Electric Potential Gradient during Monsoon Rains in Bombay

It is well known that the fair weather positive atmospheric electric potential gradient often changes its sign during disturbed weather. Rain with or without thunderstorms is mostly associated with negative potential gradient.[1] The changes of potential gradient accompanying rainfall in the monsoon months in Bombay are generally simpler in character than those associated with thunderstorms. The present note gives an analysis of the potential gradients accompanying the rains of the monsoon season.

The data were tabulated from the electrograms (obtained with a photographic electrograph of the Cambridge Instrument Co.[2]) and rainfall charts of the Colaba Observatory during June to September in 1937 and 1938. Complicated changes such as occur during thunderstorms have not been considered in detail. The results of the analysis are given in Table I.

TABLE I

Changes of potential gradient accompanying monsoon rains at Colaba, Bombay

June to September 1937 and 1938

MONTH	NUMBER OF OCCASIONS WITH							Total Number
	Pot. grad. negative A	Pot. grad. mostly negative but with positive for a small part of the time	Pot. grad. positive but with deminished value B	Sum of cols. 2, 3 & 4	Pot. grad. with increased positive value C	Pot. grad. almost unaffected	Miscellaneous change, not classifiable in any of the previous categories	
June 1937	58	5	45	108	1	18	8	135
,, 1938	41	17	46	104	4	20	12	140
July 1937	79	14	96	189	15	58	12	274
,, 1938	49	3	71	123	6	27	16	172
Aug. 1937	20	0	39	59	6	23	0	88
,, 1938	36	8	43	87	7	23	5	122
Sept. 1937	25	0	13	38	10	6	0	54
,, 1938	21	1	6	28	0	11	2	41
TOTAL ..	329	48	359	736	49	186	55	1026

It will be seen that the potential gradient became negative in nearly 35 per cent. of the cases; in another 35 per cent., although the gradient did not change sign, the positive value showed a decrease. Change of sign occurred with heavy showers and a decrease of positive gradient (without change of sign) occurred with light showers and drizzles. The instances in which the potential gradient changed sign (group A) can again be divided broadly into two classes, (1) those in which the gradient was immediately reversed with the onset of rain and recovered to the normal gradient when rain ceased and (2) those in which the gradient increased either immediately before or at the beginning of the rain and then steeply reversed and came back to the normal value at the cessation of rain. In a few cases, an increase in potential gradient was observed towards the end of the shower. It is also interesting to note that in about 5 per cent. of the cases studied the monsoon rain had the effect of increasing the positive gradient; in such cases the showers were smart and the changes of gradient lasted for brief intervals, the normal gradient shooting up at the commencement of rain and falling down to the normal value when rain ceased.

A few electrograms showing the typical changes of potential gradient and corresponding syphon rain-gauge charts, are reproduced (Figs. 1-6). It will be seen that the potential gradient changed sign and remained negative during rain at positions marked "A"; at A_1 the gradient, before becoming negative, shot up to higher positive values at or before commencement of rain; and at "A_2" the increase in gradient occurred only towards the end of the rain. At "B" the gradient registered a lower value during rain and at "C", the gradient shot up momentarily to higher positive values during smart showers.

During the period under investigation there

Typical electrograms and corresponding rainfall charts—Bombay

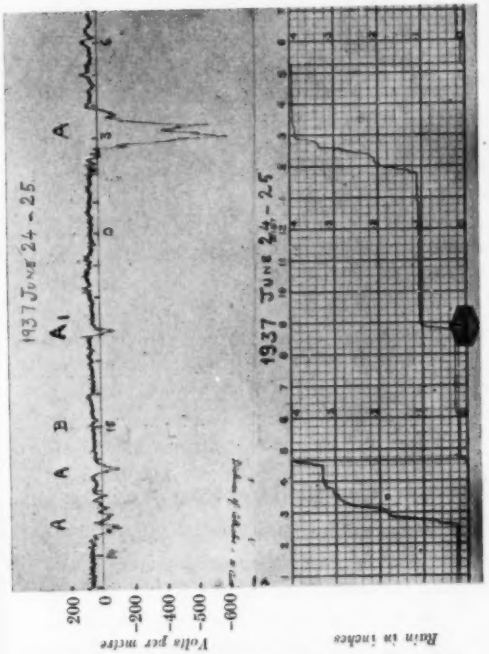

FIG. 2

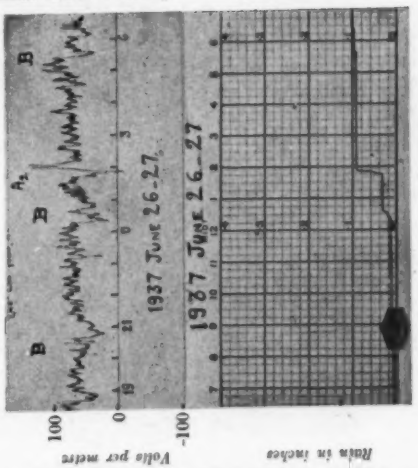

FIG. 4

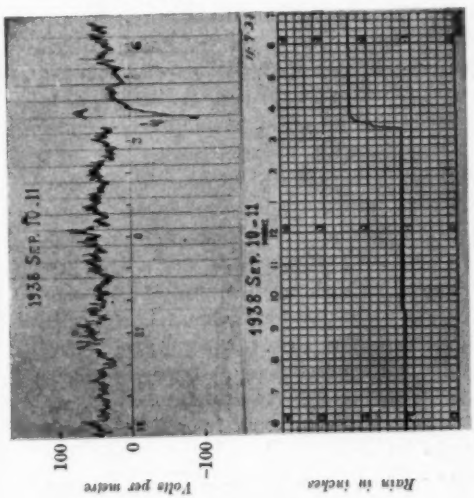

FIG. 1

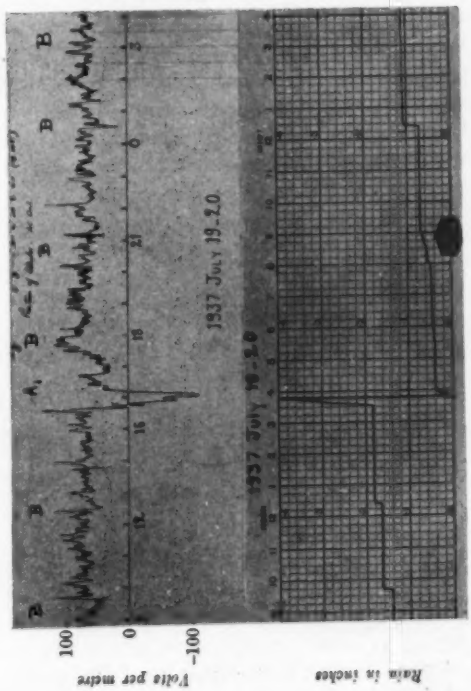

FIG. 3

Typical electrograms and corresponding rainfall charts—Bombay (*Continued*)

FIG. 5

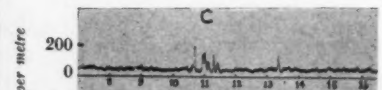

FIG. 6

were 20 occasions when the gradient was negative when no rain was recorded by the rain-gauge of the Observatory. These are mostly due to charged clouds passing over the Observatory. On the whole, the potential gradient data are consistent with the view that monsoon clouds have a distribution of charges similar to that of thunderstorm clouds with a preponderance of negative charge near the base of the cloud. Simpson and Scrase[3] found evidence in some thunderclouds of a concentration of positive charges in a limited region of the base of the cloud. The occasional positive gradients found beneath monsoon clouds are perhaps due to the existence of a similar distribution of charges in monsoon clouds.

My thanks are due to Dr. K. R. Ramanathan for suggesting this study and for his kind interest in the work.

A. R. PILLAI.

Colaba Observatory,
Bombay,
July 20, 1940.

[1] Schonland, B. F. J., *Atmospheric Electricity*, p. 62.
[2] *J. Sci. Inst.*, **5**, pp. 145–52.
[3] Simpson, Sir G., C., and Scrase, F. J., *Proc. Roy. Soc.*, 1937, A, **161**, 309.

Determination of Peroxidase Activity

IT was reported previously[1] that ascorbic acid oxidase in drumstick is accompanied by peroxidase. In subsequent experiments on the separation of these two enzymes, the need arose for a rapid method of determining peroxidase activity. The method of Willstätter and Weber[2] could not adequately supply the need. Search among other known methods suggested that the one based on the oxidation of benzidine to purpuro-benzidine[3] might be simple and rapid. On actually trying out this method, it was found, however, that the filtration of the dye, prior to its dissolution in alcohol, was tedious and time-consuming. Obviously these difficulties could be overcome by the use of an immiscible, high-boiling solvent for dissolving out the purpuro-benzidine quantitatively from the reaction mixture. It was observed that butyl alcohol admirably fulfilled these requirements. Based on this observation, the original method of Zirm *et al.*,[3] has been modified as under:—

To 50 c.c. water in a 100 c.c. separating funnel (short-stem) are added in succession (*a*) 2 c.c. of 1 per cent. benzidine in sodium acetate-

acetic acid buffer (pH. 3·5 — 3·65), (b) enzyme solution and (c) 1 c.c. H_2O_2 (1·8 mg.). The reaction is carried out at 30° C. for 5 minutes, and then stopped by addition of a 25 per cent. solution of NaOH till the solution changes from a blue to orange red colour (about 2 c.c. of alkali are required). On saturating the inactivated reaction mixture with NaCl, the dye is thrown out. This is extracted with 5 c.c. butyl alcohol. The alcohol layer containing the dye is separated and after washing once with saturated brine is drawn into a 25 c.c. flask through a filter of cotton wool (to keep out undissolved, mechanical impurities, if any). The separator is washed several times with small quantities of ethyl alcohol to complete extraction of the dye and each washing passed through the original filter. The combined filtrates are made up to 25 c.c. with ethyl alcohol. A control is run under identical conditions but with the boiled enzyme. The amount of purpuro-benzidine formed is determined in the Pulfrich Photometer (cell 20·06 mm., filter S 53) and evaluated by reference to a previously constructed standard-graph: Purpuro-benzidine *vs.* Extinction Coefficient.

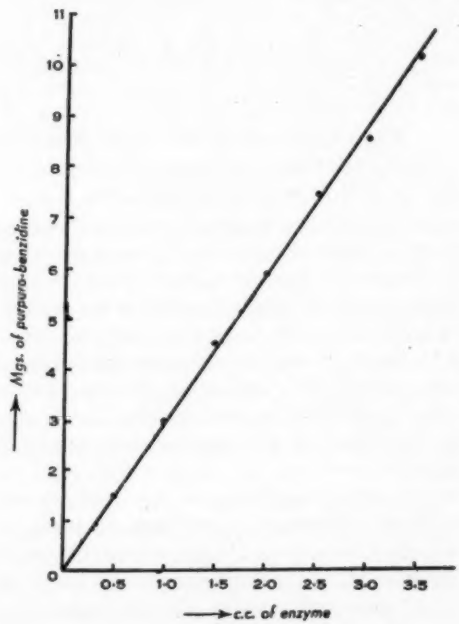

FIG. 1

The peroxidase activity of *Chow-Chow* (*Sechium edule*) enzyme extract has been determined by this method.

The graph (Fig. 1) proves that under the conditions of the experiment the amount of dye formed is strictly proportional to enzyme concentration. Consequently, for the range of enzyme concentration studied, the quantity of purpuro-benzidine which is determined, gives us an exact measure of peroxidase activity.

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July 5, 1940.

[1] Srinivasan, M., *Biochem. J.*, 1936, **30**, 2077.
[2] Willstätter and Weber, *Annalen der Chemie.*, 1926, **449**, 156.
[3] Zirm, K. L., Reuter, F., and Willstardt, H., *Biochem. Z.*, 1932, **245**, 290.

A Note on the Determination of Lead Permanganometrically (Low's Method)

HEMPEL'S method[1] as modified by Low[2] has been in use for a long time for the determination of lead permanganometrically in technical analysis. Low's method has also been adopted by the British Pharmacopea. This method which consists in precipitating the lead as oxalate from acetic acid solution, dissolving the precipitate in dilute sulphuric acid and titrating with permanganate has been criticised by Morris[3] and Wetherell[4] on the grounds that precipitation is incomplete unless carried out from a 60 per cent. acetic acid solution, and that the liberation of oxalic acid from the precipitate by dilute sulphuric acid is not quantitative. Other investigators have frequently suggested variations in procedure such as filtering on asbestos and using dilute nitric acid for the solution of the lead oxalate before the

addition of sulphuric acid. All these modifications very frequently give low results.

Coppock and Coppock[5] attributed the low results to the greater solubility of lead oxalate than calcium oxalate. However, it is evident from the data given by Riesenfeld,[6] and Kohlthoff and Furman[7] that the reverse is the case and hence the low results obtained by Low's method could not be due to this cause. Further, though the instability of dilute solutions of oxalic acid has been pointed out by several investigators, contradictory statements are found in the literature regarding the oxidisability of oxalic acid by chlorine, and nitric acid.

It has now been found that 60 per cent. acetic acid is unnecessary for quantitative precipitation of the lead oxalate, and that the use of nitric acid for solution of the lead oxalate is inadmissible as it oxidises the oxalic acid. Regarding the non-quantitative liberation of oxalic acid from the precipitate by dilute sulphuric acid, it has been found that this acid is best replaced by hydrochloric acid not only for the solution of the precipitate but also for the subsequent titration. As long as the concentration of the hydrochloric acid is well below IN, no appreciable oxidation of this acid occurs under the conditions of an oxalate-permanganate titration. A detailed account of the investigation will be published later.

The author wishes to thank Professor T. R. Seshadri for helpful criticism in the preparation of this note.

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Department of Chemistry,
Andhra University,
Waltair,
July 11, 1940.

[1] Hempel, *Jahresbericht*, 1853, 627.

[2] Low, *J. Am. Chem. Soc.*, 1893, **15**, 550; *cf.* A. H. Low, *Technical Methods of Ore Analysis*; and Scott, *Standard Methods of Chemical Analysis*.

[3] Morris, *Chem. and Drug.*, 1919, **91**, 52.

[4] Wetherell, *Quart. J. Pharm.*, 1935, **8**, 453.

[5] Coppock and Coppock, *Volumetric Analysis*, 1934.

[6] Riesenfeld-Ray, *A Manual of Practical Inorganic Chemistry*, 1933, p. 449.

[7] Kohlthoff and Furman, *Volumetric Analysis*, 1928, p. 271.

Structure of the (3, 0) Band λ2569 of the OD Molecule

In continuation of the work on the structure of the OD bands of Heavy Water reported previously[1] the (3,0) band at λ2569 has been photographed and measured. On account of the relatively small intensity of the band, exposures for about four hours have been found necessary using the medium Hilger Quartz Spectrograph (dispersion 10 Å per mm. approx. at λ2600). The band corresponds to the one at λ2447 of OH, due to the electronic transition $^2\Sigma^+ \rightarrow {}^2\pi_{inv.}$ The rotational structure has been analysed and the six main P, Q, R, branches are derived. The values of the constants have been calculated to be (in cm.$^{-1}$)

$$B'_3 = 8{\cdot}13 \qquad B''_0 = 9{\cdot}94$$

Details of the structure will be published elsewhere.

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July 14, 1940.

[1] *Curr. Sci.*, 1940, **9**, 172; 1940, **9**, 225. *Nature*, 1940, **145**, 778.

Typical Colour Curves and their Application for Purity Tests in Physiological Researches

In a recent communication[1] from these laboratories a new Photoelectric Photometer was described for chemical analysis, based on the measurement of light absorption of the solution of substance occasioning a colour reaction, within a narrowly defined region of the spectrum with the aid of a quantitatively variable light diminution; photoelectric cells (Caesium Becker & Co.) being used to indicate equivalence of light.

A successful application of the above instrument for purity tests based on colour measurements has been in an examination of chlorophyll solutions for carotenoid impurities. Carotin has a characteristic absorption in the region 560–430$\mu\mu$, the corresponding band for chlorophyll

being 750–570$\mu\mu$ (Fig. 1). It has been found by us that Beer's law holds for these mixtures and a straight line relation is obtained between the change in the logarithms of the extinction coefficient K of the mixture and the percentage of carotin, at a wave-length of 470$\mu\mu$. Curves 1 and 2 in Fig. 1 have been obtained with

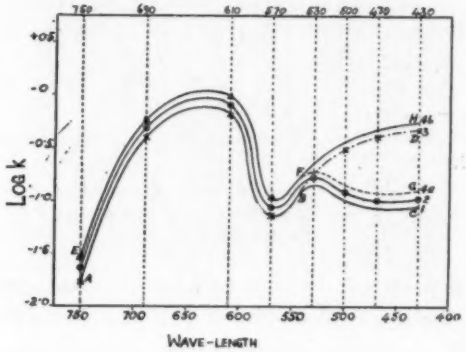

FIG. 1

Typical colour curves of chlorophyll solution in 80 per cent. methyl alcohol. Curve 1, (A B C) 4 mg. in 100 c.c. Curve 2, 6 mg. in 100 c.c. Curve 3, (A B D) 4 mg. of chlorophyll in 100 c.c. with 1·2 per cent carotin as an impurity. Curve 4*b* (E F H) drawn from observational readings of a test sample of chlorophyll. Curve 4*a* (E F G) the ideal curve for the same sample after comparing with the normal curve.

chlorophyll solutions in 80 per cent. methyl alcohol, containing in 100 c.c. 4 mg. and 6 mg. respectively. As Beer's law holds, the two curves are parallel. Curve 3 has been obtained with a solution of 4 mg. of chlorophyll in 100 c.c. and contains 1·2 per cent. carotin as an added impurity. Curve 4b is plotted from the observations on a test sample of chlorophyll. From a perusal of the region of deviation from the normal shape (Fig. 1, A B C), an ideal Curve 4*a* can be drawn and the actual change in log K caused by the carotin in this absorption region can be measured and the percentage of carotin read off from a calibration curve.

By the above procedure, it has been possible to detect carotenoid impurities in chlorophyll solutions down to a concentration of 0·05 per cent. The method of colour measurements and purity tests described here for chlorophyll solutions is applicable to other substances following Beer's law. The method has been specially useful in the laboratories in maintaining the purity of certain culture solutions by comparing their colour curves at regular intervals.

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July 25, 1940.

[1] B. N. Singh and N. K. Anantha Rao, *Plant Physiology*, April 1937.

Utility of Leaf-tip Smear Technique

FOLLOWING the method of J. T. Baldwin,[1] tips of very young leaves about 1 mm. in length from the apex were selected from the youngest terminal bud, they were put in Carnoy's fixative (chloroform-acetic acid-alcohol) for about 10 minutes, were passed through a mixture of 95 per cent. alcohol and concentrated HCl in equal proportion for not more than 5 minutes, they were again dipped in Carnoy's for 5 minutes. Now the leaf-tips were put in a drop of aceto-carmine on a slide, with the help of a scalpel these leaf-tips were torn and put under a coverglass. With uniform and gentle pressure of the scalpel on the coverglass the leaf-tips were crushed uniformly and the slides were then passed over a flame three or four times, taking care not to boil the aceto-carmine, and each time a slight pressure was applied on the coverglass to spread the smear uniformly. The slides were ringed carefully and stored in a cool place in the dark for three or four days when the nuclear stains were found to have developed satisfactorily. The slides were then made permanent according to Barbara McClintock's[2] method. The smears showed all the phases of the somatic mitosis as in Fig. 1, and in some cases the chromosome-counts were possible.

The advantage of this leaf-tip-technique is that in a short time all the phases of the nuclear division can be demonstrated to beginners in

FIG. 1

Stages of mitosis under app. objective 2 mm. eye piece. × 4 6.

cell-study. It is also a time-saving process. Young leaf-tips from the terminal buds can be easily collected all the year round whereas it becomes difficult in some cases to germinate the seeds for root-tip study and some plants take a long time to flower from the vegetative stage. Moreover, flowers are not formed all the year round.

A recent instance of the utility of this method may be cited. Two specimens of *Holarrhena antidysentrica* (vern. *Kurchi*) were sent to our laboratory from the Royal Agri-Horticultural Society at Alipur. One of the specimens was suspected to be a new variety as it never set seed and usually flowered one month later than the other. On examination of the leaf-tips of both the specimens it was found that the chromosome numbers were the same in both, and thus it can be concluded that both the plants belong to the same species. It is hoped it will have great application in the field of genetics where the counting of chromosomes play such an important part.

In conclusion I beg to express my grateful thanks to Dr. S. R. Bose, Professor of Botany, for his guidance and helpful suggestions.

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July 31, 1940.

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[1] Baldwin, J. T., "Chromosome from leaves," *Science*, 1939, **90**, 240.

[2] McClintock, B., "A method for making aceto-carmin smears permanent," *Stain Technology*, 1929, **4**, 53.

A Sterile Mutant in Safflower (*Carthamus tinctorius* L.)

DURING the year 1938–39 selfed seeds of safflower I.P. 1 were sown in pots and the seedlings transplanted in the field unlike the usual practice of sowing the seeds directly in the field. The resulting plants, sixteen in number, were poor in growth and yielded only a few seeds each under conditions of open pollination, there being no seed setting under bag in any case. Seeds from these 16 plants were grown separately in the field during 1939–40. Early in the growth of the seedlings, one culture was marked by the presence of a few peculiar plants with thick and twisted stems. As these plants grew up, they developed other peculiarities which clearly distinguished them from the normal plants. The stems, besides being thick and twisted, were unbranched, bore thick and leathery leaves which were larger than those on the normal plants, the average length and breadth of leaves on these plants being 19·44 and 8·23 cms. and those of the normal 16·01 and 6·35 cms. respectively (Fig. 1). Each of these abnormal plants produced a single, solitary, terminal capitulum which did not open and failed to set seed. On dissection, the capitulum was found to be devoid of florets, but it merely contained white bristles

FIG. 1
Mutant plants, on either side of a normal plant (centre)

which are present in the capitulum of normal plants also along with the florets (Fig. 2).

FIG. 2
Longitudinal sections through capitula of mutant (left) and normal plant

Thus a complete suppression of the floral organs rendered the plants absolutely sterile. Attempts to induce branching in one of these plants by timely topping and also to propagate them vegetatively by cuttings failed to give the desired results. The root systems and anatomy of the stems of these abnormal and normal plants were studied. Although there was no perceptible difference in the anatomy of the stems and disposition of the roots in the soil between the two types of plants, the roots themselves appeared to be less vigorous in the case of the abnormal plants.

The actual number of the abnormal and normal plants in the segregating culture was found to be 6 and 13 respectively. In spite of the small population studied, the observed ratio of the abnormal to normal plants suggests a monohybrid segregation, the abnormal condition being recessive. It is also considered possible that all the associated characters like absence of branching, twisting of the stem, increased size of leaf and its leathery texture and sterility in the abnormal plants are determined by a single recessive gene. This recessive condition itself might have been brought about by a mutation in one of the normal allelomorphs in one of the plants grown in 1938–39, which in the following year gave the observed segregation.

Seeds of the normal plants occurring in the segregating cultures and also a portion of the seed from the original heterozygous plant will be grown in the coming year for confirming the genetics of this interesting mutant which is observed for the first time.

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Otomycosis in a Woman caused by *Aspergillus niger* Tieghem

AFFLICTIONS of the auditory canal in human beings due to *Aspergillus niger* Tieghem (= *Sterigmatocystis niger* Tieghem, = *S. antacustica* Cramer) have been from time to time reported[1] from various parts of the world such as Japan, U.S.A., France, Brazil, Tunis, etc. The disease is said to be exceptionally prevalent in China and the temperate zones of America. Probably it is not infrequent in India but it appears from a search through the available literature that no record has been made about such cases in this country, at least during recent years. Butler and Bisby[2] in *The Fungi of India* mention *Aspergillus niger* as occurring within the seed of *Gossypium* and on soil and

in fermenting tea and rice. It has also been recorded from rot of apple[3] and as contamination of culture media in the laboratory.[4] It seems, therefore, desirable to record the occurrence of this fungus in the ear of a woman in Allahabad.

The patient, a woman of 48 years, has had four attacks during the last eight years. The second attack took place about two and a half years ago but the third attack which occurred last year has been followed by another one this year. Every time the trouble lasts for about a couple of months in the rainy season. In the beginning an itchy sensation is felt deep inside the ear in and around the tympanum. The pain reaches its climax in a week and the patient who feels her ear being blocked, hears only imperfectly. On syringing the ear with hydrogen peroxide a dirty grey mat of conidiophores and hyphæ comes out floating on the surface of the liquid. This gives great relief to the patient and hearing is restored. On the second day after this, the trouble again starts and on about the fourth day another mat of the size of a big 'kabuli' gram may be taken out. The process is repeated several times. In a fully formed mat clusters of erect black conidiophores can be seen, with the naked eye, projecting from the mass.

The fungus has been cultured several times from the original source and each time only *Aspergillus niger* developed. It is, therefore, pretty certain that only this organism is the cause of the trouble. The fungus has been grown on a variety of media such as Potato-glucose, Brown's starch, Barnes' medium, Oatmeal and malt agar. The best growth is obtained on Potato-glucose while on malt agar the growth is very feeble. The measurements as recorded from the original condition are given below:—

Diameter of the unruptured black globose head	130–160 μ
Length of the stalk (smooth walled)	400–700 μ
Diameter of the stalk	12–15 μ
Diameter of the vesicle ..	45–55 μ
Length of the primary phialides	25–35 μ
Length of the secondary phialides	8–12 μ
2–4 on each of the primary ones	
Spores	3·5–4·5 μ

Comparing these measurements with those given by Thom and Church[5] for this species I find that the upper limit in the size of many of the parts is exceeded by the present fungus by 2–5μ, but in view of the wide variability found in members of this species such deviations may be expected. Mention may be made about an interesting point noted in this connection. The primary phialides in the original condition measures 25–35μ in length but in culture their size decreased to 15–20μ only. The size of the other parts, however, remained the same. Experiments done in the chemical laboratory of this University showed that this strain can also convert about 90 per cent. of a solution of 3 per cent. tannic acid to gallic acid in about 6 days.

Thom and Church[5] and Dodge[6] point out that these species, probably primarily saprophytes, have found favourable conditions for growth in the cerumen of the human ear. Under ordinary conditions they are harmless beyond causing mechanical irritation but sometimes persistent ulcerations are developed. It is interesting to find that *Aspergillus niger* was first described as *Sterigmatocystis antacustica* by Cramer who obtained it from human ear! But the former name has been so much used in biochemical and other studies that it is the one now widely accepted. As the spores of *Aspergillus* are common components of dust, the disease is often ascribed to dirty habitations. This probability, however, is excluded in the case of this patient. The fact that this trouble occurs only during the rainy season shows that high humidity is an essential factor for its development.

Various antiseptics such as hydrogen peroxide, methylated spirit, hydral per chlor with or without boric acid, as advised by a doctor, have been used without much success. These reagents gave only temporary relief and the disease again appeared after a couple of days. This reappearance can be hardly ascribed to

renewed infection. Seaver[7] reports that in a similar case in his laboratory after failing with a long list of antiseptic mixtures such as carbolic acid, boric acid, mercuric chloride, etc., treatment with 50 per cent. alcohol was entirely successful but in the present case this reagent could not cure the ailment.

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Department of Botany,
University of Allahabad,
August 5, 1940.

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[1] *Review of Applied Mycology*, 1926, **5**, 163; 1928, **7**, 98; 1938, **17**, 111; 1939, **18**, 179 & 313; 1949, **19**, 218.
[2] Butler and Bisby, *The Fungi of India*, 1931.
[3] Dey, P. K., and Nigam, B. S., *Indian Journ. Agric. Sci.*, 1933, **3**, 663.
[4] De Mello, F., *J. of Ind. Botany*, 1921, **1**, 158.
[5] Thom and Church, *The Aspergilli*, 1926, p. 77.
[6] Dodge, C. W., *Medical Mycology*, 1935, p. 622
[7] Seaver, F. J., *Mycologia*, 1938, **30**, 692.

Zygnema terrestris Randh. from the Kumaon Himalayas

THIS terrestrial member of the Zygnemales was originally described by the present author from moist fields lying fallow near village Mamrezpore, tahsil Tanda, district Fyzabad, U.P. This is the only terrestrial species of *Zygnema* described so far, and is readily distinguishable from species of *Zygogonium* in the absence of cytoplasmic residue from the gametangia.

It is of interest to record the wide distribution of this alga in the Kumaon Himalayas during rainy season from August to October. It was collected from Kausani and Binsar growing on sandy bridle paths and clayey rocks. The places from where this alga was collected are at an altitude of 6,000 to 7,500 feet above sea level. The filaments were freely conjugating even in August, and ripe zygospores were seen in September and October 1939.

The samples of this alga collected from the plains, as well as from Kausani and Binsar in the hills showed scalariform mode of conjugation exclusively. However the samples which were collected from near Dhakuri and Dwali from the bridle path leading to the famous Pindari glacier at an altitude of about 8,000 feet showed lateral conjugation exclusively.

In this laterally conjugating form, vegetative cells are on the average 22–24μ broad and 36–40μ long. Cross conjugation may rarely take place, but ripe spores were not observed when the alga conjugated in this manner. Zygospores are kidney-shaped, 25–28μ broad and 38–46μ long.

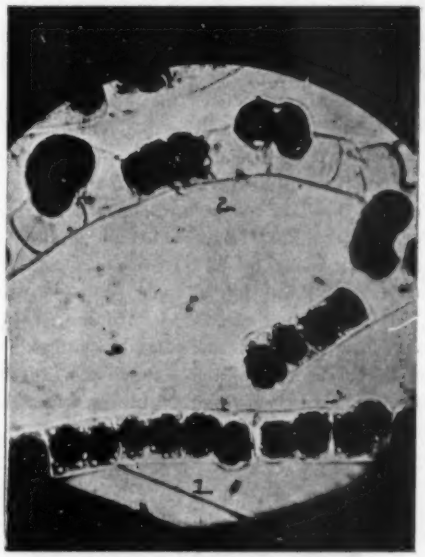

FIG. 1

Zygnema terrestris Randh.
A microphotograph showing 1. A vegetative filament; 2. Lateral and scalariform conjugation.

Ripe zygospores were not observed in the laterally conjugating samples hence it is not possible to compare the sculpturing of the spore-wall with the samples showing scalariform conjugation. However from the size of its vegetative cells, the structure of its chloroplasts and its habitat this form resembles *Z. terrestris* Randh. and is probably its laterally conjugated form.

It is of interest to note that while this alga shows an exclusively scalariform mode of conjugation in the plains and in the hills at an

altitude below 7,000 feet above sea level, higher up it conjugates almost exclusively in a lateral fashion.

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August 6, 1940.

On *Nummulites* cf. *thalicus* Davies, from the Eocene Bed in the Pondicherry Area, S. India

IT will be remembered that one of us (L. R. Rao) recently reported[1] the discovery of an Eocene bed in the Pondicherry Cretaceous area, characterised by the occurrence of the genera, *Nummulites* and *Discocyclina* which seemed to indicate that the bed in question was of Lower Eocene (Ranikot?) age. Further studies are now being made by us on the exact nature of this foraminiferal fauna and a detailed report will be published elsewhere. We should, however, like to draw immediate attention to a small radiate *Nummulites* occurring in this bed. Fig. 1 is an equatorial section of this form which

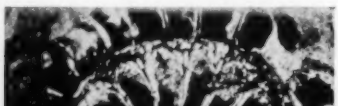

FIG. 1

Nummulites cf. *thalicus* Davies
Equatorial section. × 25. Loc.—near Pondicherry

shows (1) the paucispiral coiling of the test with chambers about three times as high as long, and (2) the septa which are straight for most of their length. Both these characters indicate that this *Nummulites* is one of the earlier and more primitive types, similar to the well-known *N. thalicus*—a typical Ranikot species in India—thus indicating that the bed containing it in Pondicherry is early Eocene in age.

It is also remarkable that the Pondicherry *Nummulites* which is a megalospheric type, shows a reticulate marginal cord which as Prof. Douville[2] has shown is characteristic of *N. planulatus* of Europe which is a microspheric type. Lt.-Col. L. M. Davies[3] has also recognised this character in *N. nuttalli* (Fig. 2)

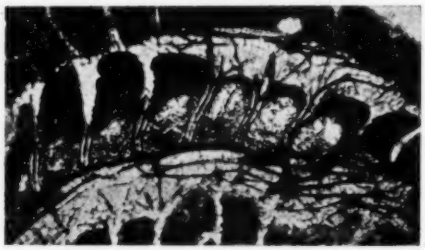

FIG. 2

Nummulites nuttalli Davies
Part of the equatorial section. × 15. Loc.—Jhirak, Sind
(From a specimen in the G. S. I. collections)

(a form closely similar to *N. planulatus*) from N.W. India, but not in *N. thalicus*—the megalospheric equivalent of *N. nuttalli*. Thus it would appear that the Pondicherry *Nummulites* is a megalospheric form recalling many of the features of the '*nuttalli-thalicus*' group, and at the same time, shows the reticulate marginal cord, noticed so far only in the microscopic *N. nuttalli*.

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July 29, 1940.

[1] *Curr. Sci.*, 1939, **8**, 166.
[2] *C.R.S.S. Soc. Geol. Fr.*, 1928, p. 93.
[3] *Pal. Ind.*, n.s., 1930, **15**, 68.

The Occurrence of 'Tornaria larva' at Krusadai*

THE interest of Zoologists in India in the Enteropneusta of Krusadai dates from 1922 when Dr. F. H. Gravely made known to them their occurrence at Krusadai Island. According to Narayana Rao,[1]‡ three genera and four species are reccgnisable in the collections made:

(i) *Chlamydothorax* (= *Ptychodera*) *krusadiensis*, (Species Novum—to be described).

(ii) *Chlamydothorax* (= *Ptychodera*) *ceylonensis*, Spengel.

(iii) *Ptychodera minuta*.

(iv) *Glandiceps hacksi*.

It is noteworthy that (i) and (ii) occur in the vicinity of Bushy Point on the Ceylon side of the Island, while (iii) and (iv) were collected from the Porites Bay and Watchman's Bay in the northern shore of the Island facing Mandapam. In the collections from the Ceylon side of the Island, *Ptychodera minuta* and *Glandiceps hacksi* have not been met with till now.§ The two species of *Chlamydothorax* (i) and (ii) occur in remarkable abundance on the Ceylon side whereas those taken in the shore facing the main-land (iii) and (iv), are rare. Subsequent attempts to collect the latter since 1934 when Ramanujam[2] obtained them, have not met with success. Though adult specimens were plentiful, no Tornaria larva could be seen in the plankton collections of the Biological Station systematically made from 1930. Is this because the development was direct in all the four species? Or was the development of these forms similar to that of *Dolichoglossus* in which it was short with a larva having a very short free swimming life? These were problems for the Zoologists to solve.

Special interest in their larvæ was aroused by a requisition for Tornaria material from Dr. G. Stiasny, of the *Rijksmuseum van Natuurlijke Historie*, Leiden, Holland, to Dr. B. Sundara Raj, Director of Fisheries, Madras, in October 1934. A cursory examination of the gonads of a few specimens of Balanoglossids from the Bushy Point in December 1934 showed somewhat ripe gonads. It was therefore assumed that the breeding season of these enteropneusta lay somewhere about the period extending from December to February. A systematic collection and examination of plankton from the vicinity of the Bushy Point was carried out in 1935–36 beginning from September 1935 and ending in March 1936. No Tornaria larva was seen in these collections. Further search for this larva was therefore given up and Dr. Stiasny was informed accordingly.

Three years later, on 3rd, 4th and 13th February 1939, in an inshore haul of plankton collected from the Kundugal channel in Lat. 9° 15′ N. and Long. 79° 13′ E. a number of Tornaria larvæ were found mixed with a few Bippinnaria larvæ. A detailed examination of these larvæ was made and it was found that all the specimens were alike and belonged to but one stage, the well-known full-grown free-swimming Tornaria larva stage (Fig. 1).

The larva has roughly the shape of a spindle. The preoral and postoral loops of the longitudinal band of cilia are well developed. The telotroch which differentiates the Tornaria larva from Bippinaria is a conspicuous feature with strong powerful cilia. The unpaired anterior cœlomic vesicle, the rudiment of the proboscis cœlomic cavity of the adult, and the two pairs of the posterior cœlomic vesicles, the rudiments of the collar cœlomic cavities and the trunk cœlomic cavities are present. There are two eyes and the apical plate but the apical tuft of cilia is absent. The last does not seem strange as this structure is absent

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* Published with the permission of the Director of Fisheries, Madras.

‡ The work on the classification of the Balanoglossids of Krusadai by Prof. C. R. Narayana Rao has not yet been published.

§ This extraordinary local distribution appears to be an instance of social isolation and it is perhaps due to different ecological factors suited to the life of the different species or genera.

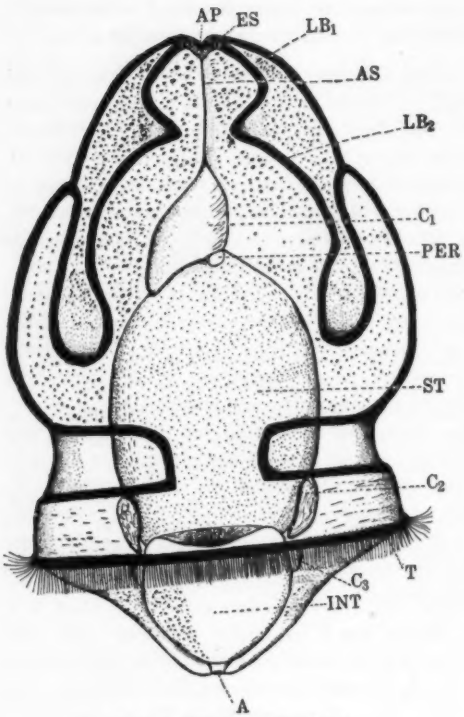


FIG. 1—'Tornaria' Krusadai

A—Anus; AP—Apical plate; AS—Apical string; C_1—Proboscis cœlom; C_2—Collar cœlom; C_3—Trunk cœlom; ES—Eye-spot; INT—Intestine; LB_1—Preoral longitudinal band of cilia; LB_2—Postoral longitudinal band of cilia; PER—Pericardium; ST—Stomach, T—Telotroch.

also in the New England Tornaria.[3] The rudiments of the future gill pouches are not seen.

Again, in the inshore plankton collected on 16th March 1939 in the same area a month later, there was a single metamorphosing Tornaria larva exhibiting elongation in its oroanal axis. It is not possible to say if this belonged to the batch of larvæ seen during February 1939. As the interval is rather long, the metamorphosis of these larvæ might have set in earlier.

As Porites Bay and Watchman's Bay adjoin Kundugal channel, one may have to seek for the parents of these larvæ in the bed of Balanoglossids there. But Bushy Point is not far off; there is a strait through which tidal currents can flow connecting the sea at Bushy Point with the Kundugal channel. One cannot, therefore, be positive that these Tornaria larvæ originated from the bed at Porites Bay and Watchman's Bay.

Last year Tornaria larvæ again occurred—(1) off Thangachimadam in Palk Bay in Lat. 9° 19′ N. and Long. 79° 14′ E., on 29th July 1939, in the off-shore plankton and (2) in the Kundugal channel on 11th August 1939 in the inshore plankton. During the current year, these larvæ appeared in the Kundugal channel on 16th and 31st January 1940 and 1st February 1940. The months in which these larvæ have occurred till now are January, February, March, July and August. This perhaps points to different breeding seasons for different species of Balanoglossids. This supposition derives support from the fact that the larvæ which appeared in January of this year are larger in size though almost at the same stage of development and different in shape from those which occurred in February of last year (Fig. 2).

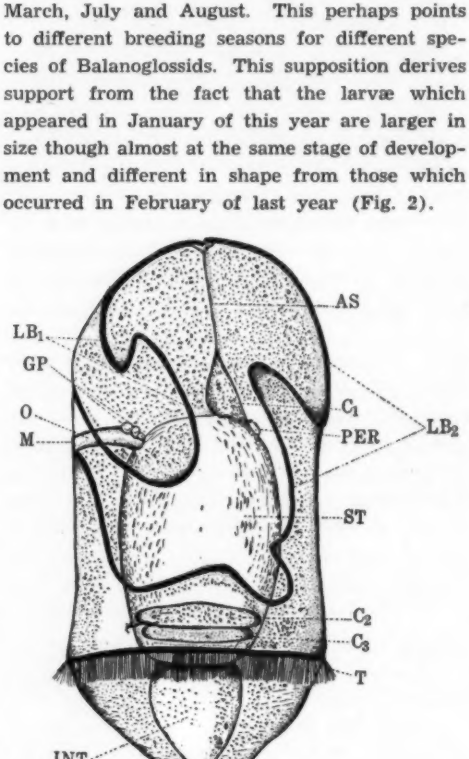


FIG. 2—'Tornaria' from the left side, Krusadai
Lettering same as in Fig. 1
GP—Gill-pouches; M—Mouth; O—Oesophagus.

The following Tornaria larvæ are known[4]:—

(*a*) *Tornaria dubia* from Naples, Italy.
(*b*) *T. mortenseni* from Misaki, Japan.
(*c*) *T. menoni* from Madras, India.
(*d*) *T. ijmai* from Misaki, Japan.
(*e*) *T. colmani* from Great Barrier Reef, Australia.
(*f*) *T. ramanujami* from Madras, India.

Of these *Tornaria menoni* and *Tornaria ramanujami* are from the sea off Madras.

A study of these Tornaria larvæ cannot be an end in itself. This is but the first step to the laborious task of referring each kind of larva to its respective parent. Such work will be rendered easy if as Bateson[5] tried and succeeded, one could attempt artificial fertilisation and rear them in Plunger jars or other Aquaria to the free-swimming Tornaria larva stage. As the number of species of the Krusadai Balanoglossids is but four, that this piece of research will meet with success at Krusadai with moderate effort cannot be doubted. When once we can distinguish the different species of the adults, and if the breeding seasons of these are ascertained by periodical examination of the gonads, it should be possible to rear artificially the Tornaria larva of each species and to distinguish their specific characters. The occurrence of the Tornaria larva indicates that development is not direct in all the species of the Krusadai Balanoglossids.

D. W. Devanesan.
S. Varadarajan.

Marine Biological Station,
Krusadai,
July 15, 1940.

[1] Narayana Rao, *Curr. Sci.*, 1934, **3**, 70.
[2] Ramanujam, *Ibid.*, 1935, **3**, 70.
[3] Stiasny, *Uber Einige Exetische Tornarien*, 1934, 1–10.
[4] *Vide* Fig. 421, in *Invertebrate Embryology*, by E. W. MacBride, p. 577.
[5] Cf. *Text-Book of Embryology*, by E. W. MacBride, 1914, **1**.
[6] *Enteropneusta*, by Ethelwynn Trewavas, Great Barrier Reef Expedition.

On the Chromosomes of an Agamid Lizard, *Calotes versicolor*, Boulen.

Researches on the Lacertilian chromosomes date as far back as 1897 when Tellyesniczki[1] studied them in *Lacerta agilis* and found that there are 24 chromosomes in that species. Many substantial contributions to our knowledge of the chromosomes of this group, however, have been made during the past few years only, mainly by Dalcq,[2] Painter,[3] Hogben,[4] Nakamura,[5] Matthey,[6] Keenan,[7] and Kan Oguma.[8] Out of these authors the results obtained by Painter, Nakamura, Matthey and Oguma are of great theoretical importance, inasmuch as, they throw a good deal of light on the phylogeny of this group and the relationship of its species *inter se*. Matthey (1931), for example, has been able to show on the basis of the chromosome complex of Agamidæ-Iguanidæ group that it is closely allied to the group of Veranidæ-Chamæleonidæ, and therefore, can be grouped under what he calls *'le complexe iguanoide'*.

It is well known that the representatives of almost all the families of lizards are found in the Indo-Malayan region, and yet, very few of them have been examined cytologically. In fact, with the exception of the work done by one of us (J.J.A.[9]) and Bhattacharya and his collaborators[10,11] on the female gonads, very little work has been done in India on the cytology of the male gonads of this interesting group of animals. It is, therefore, hoped that this first contribution to the study of chromosome numbers in Indian lizards will stimulate interest and inquiry among workers engaged in cytological studies in this country.

Calotes, the common blood-sucker, is a lizard which is commonly found in many parts of India, Ceylon, Burma and China and belongs to the ancient family of Agamidæ. According to Smith[11] (1935, pp. 180–208) there are 23 species of this genus in the Indo-Burman region and China and they are fairly well distributed over these countries. For the purpose of the present investigation, *Calotes versicolor* was

chosen on account of its being easily available in the vicinity of Ahmedabad, Western India. Animals were dissected regularly all the year round at an interval of about 20 days and testes fixed in various fixatives like Flemming's strong and weak fluids, Champy-original, Nakamura, Allen and Bouin, PFA3, and Schaffner's fixative. By far the best results were obtained by using Allen and Bouin, PFA3 and Nakamura's fixative. Considerable difficulty was experienced in finding out the period of active cell division in the testes, as *Calotes* happens to be a cold-blooded animal and hibernates in winter months in India. A series of microscopical observations on gonads fixed in the beginning and early part of the year, however, revealed that spermatogonia begin to divide actively from about the beginning of the fourth week of February till about the first week of March. In late March and early April, animal after animal comes out from its winter quarters and moves about in search of food in the early hours of the morning. The spell of winter torporation still lingers in their eyes and they usually retire to their shady homes during the hot part of the day and pass it there quietly. When testes of such animal are examined, considerable activity is noticeable in their constituent cells. Many primary spermatogonia are found to be in an active state of division and some clear metaphase plates in which chromosomes are distinct and lie well apart are obtained. The present note is mainly based on the study of chromosomes obtained in such primary spermatogonia (Fig. 1).

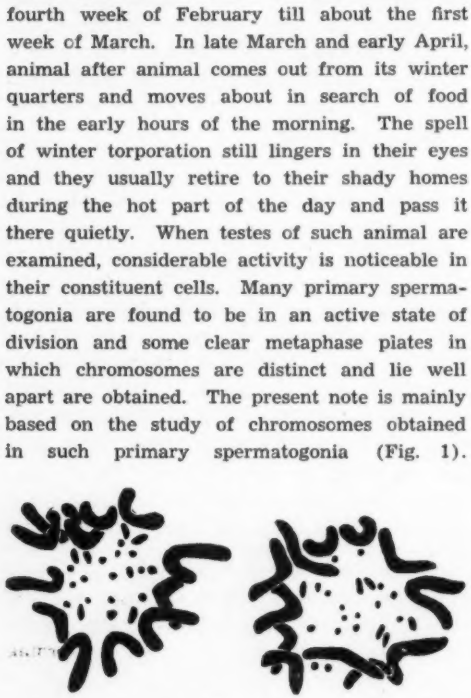


FIG. 1

Calotes versicolor—Polar views of two primary spermatogonial metaphase plates in male gonads showing 34 chromosomes. × 3,600.

Curiously enough it was also observed that such division figures were not many in the testes of animals that were opened during daytime; whereas, they were comparatively many in the material fixed at night between 11 p.m. and 3 a.m. Possibly, light seems to affect the condition of the sex cells in lizards also, as has been found to be the case in the gonads of birds and mammals.

Fig. 1 illustrates two metaphase plates observed in two primary spermatogonia. From these and the examination of some other plates it was determined that the chromosomal complex in the gonads of male *Calotes versicolor* consists of the following:—

(1) 12 large V-, U- or J-shaped chromosomes with atelomitic attachment, arranged in a ring at the periphery of the spindle,

(2) 6 medium-sized slightly elongated chromosomes with telomitic attachment, spread peripherally inside the ring of 12 V-shaped chromosomes, and

(3) 16 small dot-like microsomes, *m*-chromosomes, distributed in the central portion of the metaphase plate.

In all there are, thus, 34 chromosomes in male *Calotes versicolor*.

That there should be 12 V-shaped chromosomes in this complement also is a striking confirmation of Matthey's (1931) predictions; because, according to him, the whole *'le complexe iguanoide'* comprising six families of Autosauria, *viz.*, Anguidæ, Xantusidæ, Veranidæ, Helodermatidæ, Iguanidæ, and Agamidæ, is characterised by a peripheral ring of 12 V-shaped chromosomes with a varying number of microsomes in the centre of the spindle; and this has been found to be quite true in all the species of Agamidæ in which the chromosomes have been so far recorded. Thus, in *Agama stellio*, and *Uromastrix hardwickii* studied by Matthey (1931), and in *Japalura swinhonis* studied by Matthey (1929) and Nakamura (1931), there are 36, 36, and 46 chromosomes respectively out of which 12 are V-shaped. In *Calotes* also there are 12 V-shaped chromosomes, but the number of microsomes

in it is smaller than that observed in other Agamid lizards. This may be due to its primitive condition in the family. The only other lizard in which the same number of this category of chromosomes has been recorded is *Holbrookia texana* studied by Painter (1921); but that lizard does not belong to Agamidæ. According to Painter (1921), there are 12 macrosomes and 22 microsomes in that lizard, as against 12 macrosomes, 6 medium-sized chromosomes, and 16 microsomes in *Calotes versicolor*. The chromosomal constitution of the latter, therefore, differs much from that of the former.

Another important point that emerges from the present study of the chromosomes of male *Calotes versicolor* is in respect of its sex-mechanism. As the number of chromosomes in male *Calotes* is *even*, it is very likely that the chromosome complex in it may be of XX-type, as has been observed in a Japanese lizard, *Lacerta vivipara*, by Kan Oguma (1934).

Investigations illustrating these points and several others have been carried out in this laboratory and would be published elsewhere.

J. J. Asana.

Department of Biology,
Gujarat College,

T. S. Mahabale.

M.R. Science Institute,
Ahmedabad,
July 25, 1940.

[1] Tellyesniczki, *Math. U. Nat. Ber. Hungarn*, 1897, **13.**

[2] Dalco, *Arch. Biol.*, 1921, **31.**

[3] Painter, *Journ. Exp. Zool.*, 1921, **31**; *loc. cit.*, 1924, **39.**

[4] Hogben, *Journ. Roy. Micr. Soc.*, 1921, **91.**

[5] Nakamura, *Proc. Imp. Acad.*, Tokyo, 1928, **4**; *loc. cit.*, 1931, **7**; *Cytologia*, 1931, **2**; *loc. cit.*, 1932, **3.**

[6] Matthey, *Zeit. f. Zellforsch. u. mikr. Anat.*, 1929, **8**; *C. R. Soc. Biol.*, 1930, **103**; *Rev. suisse de Zool.*, 1931, **38**; *Ibid.*, 1933, **40.**

[7] Keenan, *Journ. Anat.*, 1932, **67.**

[8] Oguma, K., *Arch. Biol.*, 1934, **45.**

[9] Asana, *Proc. Ind. Sci. Congr.*, XIX, 1932, pp. 266–67; *Allahabad Univ. Studies* 1928 (in collaboration with Dutta).

[10] Bhattacharya, D. R., *Les Inclusions Cytoplasmiques dans l'oogenese de certain Reptiles (Thèse de Paris)*, 1925

[11] Bhattacharya, D. R., *Allahabad Univ. Studies*, 1929, **6.**

Sagitta bedoti Béraneck in Madras Plankton

Very recently I examined the *Sagitta* in the Plankton collection in the laboratory and was surprised to find that one of the commonest forms, *S. bedoti*, has not been recorded from Madras up till now. In 1933 John[1] recorded five species, *viz.*, *S. enflata*, *S. gardineri*, *S. neglecta*, *S. tenuis* and *S. robusta* and mentioned in a later paper[2] the occurrence of two more species, *S. hispida* and *S. planktonis*. From an examination I find only the three species *S. enflata*, *S. bedoti* and *S. tenuis* occurring commonly in the Plankton. Out of the seven species described by John, *S. gardineri* at least seems to be a synonym of *S. enflata* (Fowler,[3] Michael,[4] Tokioka[5]).

Sagitta bedoti Béraneck occurs throughout the year, the number varying with the seasons. Following Michael[6] I give below a table giving the measurements of the various diagnostic characters, from 20 specimens.

It appears from a comparison of the above with the description and measurements of *S. robusta* given by John[1] that what he identified as *S. robusta* is *S. bedoti*. Michael[4] considers *S. robusta* Doncaster as identical with *S. hispida* Conant and gives for comparison a table of measurements of the two species. A perusal of the table shows that in *S. robusta* the posterior fins are longer than the anterior. Fowler[3] who redescribed *S. robusta* states that the posterior fins are longer and uses this character to distinguish *S. robusta* from *S. ferox*. On the other hand in John's[1] description it is stated (p. 5) that the anterior fins are longer, and the measurements given are 27–29 per cent. for the anterior fin and 18–20 per cent. for the posterior fin. Apparently what John had before him was not *S. robusta* but *S. bedoti*.

The occurrence of *S. bedoti* in Madras Plankton is not surprising since it seems to be characteristic of the upper epi-plankton of the Indo-Pacific region. It has been recorded from the Natal Coast by the Gauss Expedition, from the Bombay Harbour by Lele and Gae,[7] from the

TABLE

Number	Length in Millimetres	Width	Length of Tail	Tail to Ventral ganglion	Anterior Fin				Posterior Fin			No. of Anterior Teeth	No. of Posterior Teeth	No. of Prehensile Spines
					To ventral Ganglion	To posterior fin	Length	Width	Length	Width	% in front of tail septum			
1	4·31	5	26·	66	Nil	6	22	3	21	4	40	6–6	10–10	7–7
2	5·17	5	26·6	66·6	1·6	6·6	21·6	3·3	20	3·3	41·7	7–8	12–12	8–8
3	7·07	6·1	27·7	?	?	4·8	26·8	3·6	21·4	4·8	40	7–7	14–14	7–7
4	7·15	7·2	27·7	69·7	Nil	6	22·9	2·9	19·2	5·4	37·5	8–9	12–14	7–8
5	7·24	5·9	26·2	?	?	4·8	25	3·6	22·6	4·8	42·1	8–8	12–12	7–8
6	7·58	5·6	26·1	70·4	Nil	5·7	27·3	3·4	21·6	4·5	42·1	6–7	12–12	8–8
7	8·01	5·4	26·8	69·8	2·1	6·4	24·7	3·7	21·5	4·3	42	6–7	12–14	7–7
8	8·01	5·3	25·8	69·9	2·1	6·4	26·8	3·2	22·6	4·3	47·6	6–7	14–14	7–8
9	8·01	6·4	25·8	?	?	7·5	26·9	3·2	20·4	4·3	42·1	8–8	12–12	7–7
10	8·19	6·3	28·4	70·5	Nil	6·3	27·1	3·2	23·2	4·2	40·9	6–6	12–12	7–8
11	8·62	5·2	27·	70·	2·5	11	23	2·5	17	3·3	35·3	6–6	13–12	7–7
12	8·88	5·6	25·2	70·8	Nil	5·8	23·3	2·8	21·3	3·3	45·4	6–8	15–16	7–7
13	8·96	5·2	24·7	70·4	Nil	5·7	26·6	2·8	20·9	3·8	45·4	9–9	17–17	7–7
14	8·96	5·8	25·	69·2	Nil	8·6	26·9	2·9	18·2	3·8	42·1	6–7	13–13	6–6
15	9·05	6·7	23·1	66·5	Nil	6·2	27·6	3·8	21·1	3·8	45·5	7–8	15–16	7–7
16	9·22	4·7	26·1	70·0	2·8	8·4	24·3	2·8	20·5	4·2	40·9	8–8	13–14	8–9
17	9·48	5·5	27·3	70·9	2·3	8·2	26·4	3·2	19·1	3·6	42·8	9–10	15–16	7–7
18	9·73	5·3	25·7	69·0	Nil	6·2	26·5	2·7	23	2·9	41·1	9–10	14–16	7–7
19	11·03	4·7	25·	69·6	Nil	6·2	26·6	2·3	21·1	3·1	44·4	10–10	14–14	7–7
20	11·10	5·4	27·7	73·1	Nil	7·7	27·7	3·1	20·7	3·8	40·9	10–10	16–16	7–7

Maldive and Laccadive Archipelago (as *S. polyodon*) by Doncaster,[8] from the Malay Archipelago by Béraneck,[9] from the Siboga region by Fowler,[3] from the Philippine waters by Michael,[6] from Misaki Harbour (as *S. bipunctata*) by Aida,[10] from Sagami and Suruga bays of Japan by Tokioka,[5] and from Australia by Ritter-Zahony.[11]

M. K. SUBRAMANIAM.

Department of Zoology,
University of Madras,
July 30, 1940.

* All measurements made in per cent. of total length of animal.

[1] John, C.C., *Bull. Madras Mus. (N.S.) Nat. Hist.*, 1933, **3** (4), 1.

[2] —, *Rec. Ind. Mus.*, 1937, **39**, 83.

[3] Fowler, G. H., *Siboga Expeditie*, 1906, **21**, 6.

[4] Michael, E. L., *Univ. California Publns. Zool.*, 1911, **8**, 21.

[5] Tokioka, T., *Rec. Oceanogr. Works in Japan*, 1939, **10**, 123.

[6] Michael, E. L., *Smithson. Instit. U. S. Nat. Mus. Bull.*, 1919, 100, **1**, 235.

[7] Lele, S. H., and Gae, P. B., *Journ. Bombay Univ.*, 1936, **4**, 1.

[8] Doncaster, L., *Fauna and Geogr. Maldive-Laccadive Archipel.*, 1902, **1**, 209.

[9] Béraneck, E., *Rev. Suisse Zool.*, 1895, **3**, 137.

[10] Aida, T., *Annot. Zool. Japon*, 1897, **1**, 79.

[11] Von Ritter-Zahony, *Ergebn. Hamburg. Südw-Austral. Forsch.* 1910, **3**, 125.

Indian Honey

THE genuineness of Indian honey is not to be assessed by the uncritical application of Western standards.

It cannot be too often pointed out that while the determination of analytical results in the case of foodstuffs often requires a high degree of experimental skill, the interpretation of the results may be a far more delicate matter, demanding experience, judgment and caution.

A suspected sample of honey was examined by us with the following result: Water 22 per cent.; Ash, 0·2 per cent. in which sulphate was present, chloride absent; 'Specific' rotation of the total solids, −11°, changing to −15° on inversion with acid.

Now the average values for European and

American honey are: Water, 20 per cent.; Ash, 0·25 per cent., free from sulphate and chloride; 'Specific' rotation, +3° to −3°, changing little on inversion. If the ash is high and contains sulphate, adulteration with invert sugar is indicated; if it contains chloride adulteration with molasses may be suspected. A high positive rotation suggests sucrose or 'starch sugar' (crude glucose), negative, invert sugar.

If we apply these considerations to the above analytical results, we see that the water and ash are normal, and the change of rotation (representing about 5 per cent. sucrose) is reasonable; but the high negative rotation, −11° inverting to −15°, clearly indicates heavy adulteration with invert sugar, provided only it is known that the honey had not crystallised before being strained from the comb, since dextrose crystallises first leaving the residual syrup lævorotatory.

Before making a report, however, we secured some authentic samples in the comb. Two bees are common here, a little one *Apis Indica* and a big one *Apis Dorsata*, var. *Nigri Pennis*. The honey of both these bees gave results so like those obtained for the suspected sample as to fully vindicate its genuineness, as will be seen from the following table:

	Western average	Suspected sample	Big Bees' honey	Little Bees' honey
Water %	20	22	16·5	16·3
Ash %	0·25	0·20 sulph. +	0·01 sulph. —	0·27 sulph. +
Rotation	+3°/−3°	− 11°	− 10°·6	− 9°·6
After invn.	,,	− 15°	− 14°	− 10°·2

Our samples were taken near Agra in April when the bees' chief source of supply was probably the flowers of the *nim* tree. At other times of the year, the results might be very different; English honey being essentially 'summer honey' is probably more uniform. It would be interesting to know whether honey from other parts of India is strongly lævorotatory, a fact which is not easy to account for.

R. D. Gupta.
H. Krall.

Chemistry Department,
Agra College,
Agra,
June 28, 1940.

A Correction

I beg to point out some fundamental mistakes in the article on "A Proposed Classification of the Nasal Elevation Index" by Mr. Sasanka Sekhar Sarkar of Bose Institute in the *Journal of the Indian Anthropological Institute*, Vol. I, Nos. 1 and 2, 1938, published in 1939.

In page 63 the writer has used the term nasal length (*n* to *ns*) which has long been discarded by Martin and others. He will also find that even in the Monaco Agreement 1906[1] (to which he has given reference) this is termed as nasal height. Moreover the nasal length and the nasal height have been distinguished by Martin.[2] In the case of nasal length, the landmarks are nasion to prosnasion (Martin, p. 189) and in the case of nasal height it will be (in the case of living) nasion to subnasale (Martin, p. 188). The writer has also mentioned that the nasal length (?) is measured from nasion to nasospinale in the living. This is absolutely incorrect. In the case of living subjects the nasospinale point cannot be located without piercing through the skin to find out the bony ridge. This is practically impossible. The landmarks in the case of living will be nasion to subnasale or the nasal septum where it joins the upper lip.

J. K. Bose.

Department of Anthropology,
Calcutta University,
Calcutta,
July 31, 1940.

[1] Hardlicka, Ales, *Anthropometry*, 1920, p. 22.

[2] Martin, R., *Lehrbuch der Anthropologie*, I, Jena, 1928, pp. 188, 189.

REVIEWS

Essays in Polynesian Ethnology. By Robert W. Williamson. Edited by Ralph Paddington. (Cambridge University Press), 1939. Pp. xlii + 373. Price 25*sh.* net.

This book consists of essays, articles and memoirs on Polynesian cultural history, left unpublished by the late Robert Williamson who was a reputed authority on the social and political systems of Central Polynesia. In bringing the manuscripts together Dr. Paddington has reviewed all the valuable material which has appeared since Williamson's death. This book is not a collation of ethnographic evidence of the religion, social organisation and customs of Polynesian races, but forms an illuminating and penetrating analysis of the history and origins of the culture, general migration and subsequent inter-island movements of Polynesians. The manuscripts left behind by Williamson deal mainly with the problems of migration and inter-island movements, but no attempt was made to discuss the more general problems, namely what historical inferences could be drawn from the existing Polynesian material. In the second part of the present book Dr. Paddington has given a review of the position of historical ethnology in Polynesia. Such a review must necessarily enter into the controversy between the historical and functional schools, which is a logical development from the earlier conflict between parallelism or evolutionism on the one hand and diffusionism on the other. The Preface forms an admirable critical analysis of the divergence of opinion between functionalists and historians on the social and political developments, religious faiths, superstitious customs and beliefs and practices among the primitive races.

The first part of the book consists of five chapters dealing with "Warfare in Central Polynesia", "Kava in Samoa and Tonga", "Kava in other Polynesian Islands", "The Arioi" and "Sex, Courtship and Infanticide". We may state at once that the causes of war among the savage tribes are not different from those which provoke international hostilities among civilized communities, and wars are declared by the war councils of the primitive people after the fashion of the democratic political cabinets. In Tahiti, Samoa and Tonga islands practically all the male inhabitants capable of handling a club were conscripted for war service, and the only members who were exempted were women, children, old and diseased men, priests and "Spiritual Kings". However, the bolder spirits among women acted as camp followers, cooks, nurses and scouts and it was not uncommon for women of the opposing forces (as in Penrhyn island) to attack each other, tear each other's hair and garments—only too familiar with all civilised women—to be displayed as trophies. Lest the enemy clutch a handful of such prizes, they took the precaution to reduce them to the minimum. The religious observances associated with warfare included the taking into battle of images or emblems of Gods, to whom particularly human sacrifices were offered, apart from the terrible feast awaiting the termination of the battle; the priests singing prayers and hymns in praise of the Deity; and strange rituals connected with the sacred canoes of Oro and other Gods. While the kings and chiefs marshalled, armed and reviewed the warriors, the priests were unremitting in their prayers to the Gods.

The victors in the battle engaged themselves in another ceremony in connection with division of the spoils and the appropriation of the enemy's country; it was regarded as a ceremony of devoting the slain to the Gods, praying "Let the God of War return to the World of Night, Let Ru, the God of Peace preside in the World of Light". Perhaps the "new world order" may be born in the Island of Samoa, the people of which have successfully and satisfactorily solved many of the human problems which perplex civilization. In this as in the neighbouring islands:

> "The meeting of two hostile armies was the occasion for preliminary acts of mutual courtesy. Each presented to the other a piece of Kava, 'this is for you chiefs and warriors to drink', these offerings being made and accepted with the most polite words. Then would perhaps follow a discussion as to whether they should begin hostilities at once or postpone them, say, till next day; this discussion might last for some time, the leaders of each army modestly disclaiming the propriety of discussing such matters in the presence of such chiefs and warriors as their opponents, and wishing to avoid the appearance of an attitude of dictation. If for

some reason, say, the approach of night, fighting, or "trampling the grass," as it is called, was postponed till the next day, the two opposing armies would lie through the night quite close to each other, without the slightest fear of treachery on either side. Apparently a custom of a somewhat similar kind prevailed in Tongareva."

The peace ceremonies were equally endearing, the mortal enemies embraced, kissed each other and offered feasts and prayers.

The custom of drinking Kava, an infusion of the roots of the plant *Piper methysticum*, widely practised throughout Central Polynesia, was attended by an extremely complicated and elaborate ceremony. The Arioi organisation of professional entertainers was one of the most important institutions of Society Island culture. It has, however, been suppressed under missionary influence. Chapter IV is devoted to a detailed consideration of the magico-religious phases of the society and the bearing of their more general aspects in the historical connection between the Arioi and the secret societies of Melanesia. Judged by the evidence regarding the customs and practices relating to sex and courtship, the Polynesian usages seem to have resolved themselves to simplicity itself. When man first conceived the idea of exclusive possession—no matter what the object of his possession was—he also laid the foundation of all moral and penal codes which are non-existent in human societies where sex and property are not regarded as sinful or as things to be exclusively possessed. The progress of religion, culture and civilization, in the ultimate analysis, is the hardening of injunctions and prohibitions, though it is inconceivable how one part of the human anatomy could have become more shameful than another or why the bounties of nature should be monopolised. The thing started in the doctrine "Might is Right", and the same principle masquerades under the theory "Possession is nine points in Law", the tenth being annexed in the judicial courts.

Throughout the Polynesian area there is a general cultural homogeneity of language, religion, technology and social organisation combined with striking differences between the various island groups. The sixth chapter deals with the most general problems of historical ethnology in Polynesia, respecting the stability and change in the culture of the people.

Part II forms an important study in assessing the present position of historical researches in Polynesia, with special reference to certain views propounded since Williamson's death. It deals with the recent theories of Polynesian origins, having a bearing on the controversy between the historical and functional schools, which is undoubtedly the most important issue in anthropological study to-day.

The book forms a notable contribution to our knowledge of the Polynesian races. The problems are treated in a critical and scholarly style, and in its comprehensiveness the book ably maintains the traditional prestige of research and study intimately attaching to the Cambridge University Publications. There is an embarrassing wealth of bibliography, a map and an exhaustive index. The illustrations, though few, are carefully selected and beautifully reproduced.

Animal Behaviour (Impulse, Intelligence, Instinct). By Dr. Johann A. Loeser. Illustrated by Erna Piuner. (Macmillan & Co., Ltd., London), 1940. Pp. x + 178. Price 10*sh.* 6*d.* net.

We have been taught by the professors of religion and theology to believe that animals lower in scale than man are not endowed with powers of reason, judgment and will, which are, however, the peculiar attributes of "the image of God". That school of biological thinkers who advocate the mechanistic conception of life simply regard animals and man as automatons. The former view is as flattering as the latter is partial and inadequate. The arguments of the book form a refutation of these theories.

Dr. Loeser, formerly of the University of Berlin, was a keen observer of animal behaviour and when, in 1938, he arrived in England as a political refugee, he was persuaded to publish his rather revolutionary views which were then unknown to the British public. The untimely death of the author deprived the book of the benefit of revision of certain important sections of it, which he had intended to do in the light of the new investigations. If we accept the principle of the animal origin of man, then it follows that all his mental attributes and faculties must have animal counterparts, and the difference can only be quantitative and not qualitative. The general needs and

purposes of life in the functional or biological sphere cannot extend beyond "Avoidance of pain, need of food, impulses leading to propagation, formation of herds and states and migrations". In every one of these departments of activity, the behaviour of animals, including the lowest organisms, seems purposive, directed to the achieving of a definite object, and the processes involved appear as complicated and intelligent as those characterising the higher animals. In other words, all animals act according to the psychological laws, limited by their organisation and governing their own nature, and this power of adjustment of their actions in conformity with the varying conditions of environment, which we may call "free will" can not be fundamentally different from the "free will" of man. It must be remembered that the faculties we call "feeling, reason, judgment and will" depend for their manifestation upon and are limited by the evolutionary phase of the physical organisation of animals including man, and there can be only one law for them all. Reactions to impulses must naturally vary where the animal organisation presents a bewildering variety of modifications, and it is almost inconceivable how an absolute and invariable connection can exist between reactions and impulses. The ideas of instinct and reflex actions, derived from the theory of preformation and mechanistic concepts will be found inconclusive and unsatisfactory. In the fourteen chapters of which the book consists, the author has endeavoured to demonstrate in general outline that organic acts caused by simple sensations are based on the principle of free, intelligent action, and to prove that the assumption of a preformed mechanism, under the name of impulse, instinct or by any other term, which functions with unconscious purposiveness and pursues and attains a specific biological end with automatic certainty, has in no case been necessary or tenable.

The book provides very stimulating reading, and within its short compass is brought together a mass of observations, appropriately arranged under the different categories of animal behaviour, with inferences and deductions which must inevitably follow from their dispassionate study. Those who have not passed through the discipline of science, will find in this little book both pleasure and profit.

Theory of Probability. By Harold Jeffreys. (Oxford University Press, Oxford), 1939. Pp. 380. Price 21*sh.*

The idea of the likelihood of an event has always fascinated the common man as well as the scientist. From application to games of chance the theory has gone on to conquer wider and more important fields, and at present it reigns supreme in the realms of natural and social sciences. The materialism and determinism of the nineteenth century have given place to an indeterminism which ought to have been obvious to any one after the work of Gauss on the Theory of Errors, but which had to wait for a hundred years to be introduced by Bohr and Heisenberg as a fundamental result in science. The consequence is that a law of nature is no longer believed to be a cut and dried rule according to which events take place, but is assumed to be merely a statement of probabilities and uncertainties.

Since Laplace gave the first analytical theory of probability, many eminent workers have tried to put forward a self-consistent scheme. During the last half-century such efforts have been made by Poincare, Borel, R. Mises, F. P. Ramsey and others. Professor Borels' school in Paris is entirely devoted to the development of the theory of probability and its applications and a number of volumes in Borels' collection have already been published.

Dr. Jeffreys' book is a welcome addition to the literature on the subject, and presents the theory of probability on a systematic and well-conceived plan which has been admirably executed. The main object of the book is to provide a method of drawing inferences from observational data which will be self-consistent and which can be used in practice. The author refutes the thesis that induction can be reduced to deduction and claims that the former is more general than the latter. The principles enunciated by him rule out any definition of probability in terms of infinite sets of possible observations, for he remarks that an infinite number of observations cannot be made. The fundamental idea is not simply the probability of a proposition p, but the probability of p on data q, thus making probability a function of two arguments instead of one as done hitherto. The notation throughout the book is that of Whitehead and Russell's *Principia Mathematica*. The number associated with the probability

is written in Dirac's bracket notation used in quantum mechanics.

After laying down the general rules for the construction of a consistent theory of induction, the author deals with direct probabilities in the second chapter, giving a detailed account of sampling, sampling with replacement and multiple sampling. The normal law of error, the Pearson laws and the negative binomial law are derived. The characteristic function and its uses in the t-, and z-distributions are calculated.

The third chapter deals with estimation problems, and the unknown parameters are evaluated in several important cases. The Bayes-Laplace theory is extended to the sampling of a finite population. The fundamental result in this section is the principle that "any clearly stated law has a finite prior probability and therefore an appreciable posterior probability until there is a definite evidence against it". The method of least squares is considered as an extension of the estimation problem.

Approximate methods for the estimation of maximum likelihood and successive approximations for the least square equations are given in the fourth chapter. Simplifications are introduced by the use of expectations. It is shown in detail how the observed data can be smoothed out in our quest to find the unknown law.

Then there are two lengthy chapters on significance tests. This is perhaps the most important part of the book from the point of view of the statisticians. The questions of simple contingency, comparison of samples, consistency tests, comparison of correlations, independence tests, deduction as an approximation, etc., are thrashed out in an adequate manner, and the work of Fisher and other workers is discussed in great detail.

In the seventh chapter on Frequency Definitions and Direct Methods, the three definitions of probability, *viz.*, the classical definition given by De Moivre, the Venn-limit definition adopted by R. Mises and Fisher's hypothetical-infinite-population definition have been analysed and their various advantages and defects pointed out, showing at the same time that, contrary to current belief, the three definitions are not equivalent. The author himself claims to be in general agreement with Professor Fisher.

The book abounds with discussions on scientific method and inference, determinism and free-will, observables in quantum theory and relativity, and on many such topics of importance and interest. It has all the qualities of lucidity and terseness characteristic of Dr. Jeffreys' writings. It has been published in the *International Series of Monographs* on Physics and its printing and get-up are of the high standard associated with these volumes. M. R. Siddiqi.

Properties of Ordinary Water-Substance. By N. Ernest Dorsey. (Reinhold Publishing Corporation, New York; Chapman & Hall, Ltd., London), 1940. Pp. 673. Price $15·00.

Water is a remarkable substance, not merely from the standpoint of its abundance in Nature, but also due to its abnormal physical and chemical properties. It plays a predominant role in biological and physical processes and is indispensable for sustenance of all kinds of terrestrial life. It is noteworthy that no proper treatise on such an important substance was till recently available in English literature. Mellor has, in his *Treatise on Inorganic Chemistry*, given a comprehensive account of water, but due to the limitations of the scope of his work, the information could not be complete.

This void in scientific literature is filled, with credit, by the book, *Properties of Ordinary Water-Substance* by N. E. Dorsey, which is sure to be an exceedingly useful addition to both scientific and popular libraries. The term "Ordinary Water-Substance" sounds queer and the author could have had it as simple plain "water" without sacrificing the implication that it includes this substance in all its phases.

This compilation deals with all physical aspects of water, comprising within its scope profuse numerical data preceded by explanatory notes which make the work complete in itself. The discussions accompanying many items are unbiassed, and the author has given all viewpoints. Full use of the facilities available at the *National Bureau of Standards* was made in presenting a complete bibliography on work done on every aspect of water. It is difficult to find any omission in respect of either references or data regarding any property of water. The reader may feel disappointed at the omission of the chemical and solvent properties of water, but the treatise being comprehensive even as it is, the author has done well in excluding these aspects from the purview of

this work. There are, however, a few items whose inclusion would have made the book more interesting. For example, a lay reader may appreciate an account, with the probable explanation, of the difference in the colours of different seas.

The explanatory notes and formulas in many places are brief and to the point, but one cannot fail to notice the partiality of the author for Debye's theory of Dipoles which he has developed in detail. Though it is not possible to minimise the importance of this theory, a mere mention of the final formula would have made this portion of the subject consistent with others where the formulas only are given.

The general get-up and presentation of matter are up to the standard of the *American Chemical Society Monographs*. But on going through the book, one cannot fail to notice the mixing up of running matter and tables, and there are not a few instances where one finds difficulty in locating the continuation of the text. The publishers would have done well by presenting the running matter and tables in different types.

The book is highly commendable for both physicists and chemists and no library can be complete without a copy of this.

I. RAMAKRISHNA RAO.

Plant Physiology. By Bernard S. Meyer and Donald B. Anderson. (Chapman & Hall, Ltd., London), 1940. Pp. 696. Price 24*sh.*

Meyer and Anderson have rendered a great service to students of plant sciences in bringing out the text-book on plant physiology for colleges and Universities. The need for a suitable text on the subject was keenly felt by all concerned as the available books on the subject had either become out-of-date or did not fully meet the requirements of undergraduates. The absence of a suitable text-book was a great handicap both to students and teachers and consequently students in general could not keep abreast of modern developments in plant physiology.

During the last few years highly specialised monographs dealing with particular topics such as photosynthesis, transpiration, respiration and permeability have been published by authorities but they were meant more for research workers than for students taking a degree course in Botany. Other books on plant physiology that have been published in recent years were found to be unbalanced in their contents. Many important aspects were completely omitted while some others were dealt with in greater detail than were required for a text-book. Personal opinions and predilections had also found their way in the text.

The publication of the text-book under review should, therefore, be welcome as it puts in the hands of students a concise and up-to-date information on all aspects of plant physiology. Its contents are well balanced and every important topic is included while superfluous details are omitted. In short it is a text-book in the true sense of the word.

Recent discoveries and concepts are well summarised and chapters on diffusion, permeability, physical properties of sols and gels, and growth hormones are well written. The book will thus prove a useful guide to teachers and a great boon to students.

A perusal of the book will at once bring home the fact, not yet adequately appreciated, that a sound knowledge of the principles of chemistry and physics is a prerequisite to the study of modern plant physiology. There is no aspect of plant physiology which can be understood in the absence of that knowledge and this book amply supports this view. Those who do not possess the knowledge of these sister-sciences will find many chapters of the book stiff reading.

A bibliography of relevant books and original papers is appended to each chapter for collateral reading. Useful guidance is, therefore, furnished for obtaining more detailed information on the subject-matter of each chapter.

There can be no doubt that this book will soon be appreciated by all who read or teach plant physiology and will find a place amongst the prescribed or recommended books in all our Universities. It is also expected that it will remain long as a standard book on this branch of plant sciences.

It is a book that should prove of value to those engaged in agricultural research. In order to find out improved methods of cultivating the crop plants, and of increasing their yields, an understanding of the inner working of the plant is essential and this book gives that insight.

R. H. DASTUR.

Biology of the Vertebrates: A Comparative Study of Man and His Animal Allies. By Herbert Eugene Walter. Revised Edition. (Macmillan & Company, Ltd., London), 1939. Pp. 882. Price 21*sh.*

Prof. Walter is a well-known author and his books are usually well written and analytical, and command a good sale. It is not surprising, therefore, that the first edition of this book published in 1928 has within ten years gone through eleven editions. Prof. Walter has now brought out a revised edition, as he felt the time has come for drastic changes and the addition of new material. The present Edition consists of 882 pages, 93 pages more than the last and has 737 illustrations including 80 new ones. The entire text has been rewritten. The book consists of three parts. Part one forms the background or introduction for the other two and deals with Taxonomy, Chorology, Palæontology, Anthropology, Cytology, Histology, Embryology, and Pathology—practically all important aspects of Zoology. Parts 2 and 3 relate to Physiology, the mechanism of metabolism and reproduction being treated in Part 2 while in Part 3, the mechanism of motion and sensation is dealt with.

Prof. Walter is a racy and effective writer and the book abounds in interesting and useful information which will interest even a lay-reader. The book may, however, be a little puzzling to Indian students as the author throughout adopts American spelling —fetus, travelers, esophagus, marvelous, feces, etc. He evidently disapproves of systematists who take a malevolent delight in changing familiar names and the yellow-fever mosquito still goes in this book with its old familiar name of *Stegomyia fasciata*. The posture of *Kiwi* in Fig. 47 appears unnatural.

The book will be found highly useful by all students of Zoology, though primarily written for the pre-medical student in America. The book contains a fund of information, well put in proper context. The revised edition will undoubtedly be as popular and call for frequent reprintings as the first edition.

S. G. M. R.

Guide to the Study of the Anatomy of the Shark, the Necturus and the Cat. By Samuel Eddy, Clarence P. Oliver and John P. Turner. (John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London), 1939. Pp. vii + 100. Price 11*sh.* net.

The book is intended to serve as a guide, in practical work, to students of comparative vertebrate anatomy at the University of Minnesota. The course is designed to be gone through in one quarter. The three forms, the spiny dogfish shark (*Squalus acanthias*), Necturus, and the Cat are chosen as they represent important stages in vertebrate development. It would have been well, in the reviewer's opinion, if the gap between Necturus and the Cat had been bridged over by the addition of another type — a reptile. The authors deal with the anatomy of the dogfish shark fairly exhaustively. The description follows, more or less, the various steps adopted by the student in his actual dissection with the result that descriptions of some of the systems are somewhat interchanged. Thus in dealing with the anatomy of the shark the authors end with the description of the skull instead of giving it a more forward position. There is a small section on the skull of the cod fish, though there is no mention of this in the title of the book. This is introduced as a preparation for the study of the more complicated skull of the higher vertebrates. The anatomy of Necturus is fully dealt with. The method of treatment adopted is the same as for shark. In dealing with Necturus and the Cat the authors have given a partial description of some of the outstanding muscles in order to give the student some experience in the dissection of muscles. Throughout the book the authors have adopted a perfectly simple and direct style best suited for the beginner in his study of vertebrate comparative anatomy. Unnecessary details are carefully avoided. The few figures given are simple and clear cut.

A book of this kind, however, should be illustrated with a larger number of diagrams. There are just 15 diagrams for the 3 types dealt with, the result being that several important organ systems go without illustrations. There is a good index.

R. Gopala Aiyar.

Laboratory Directions in General Zoology. By W. C. Curtis and M. J. Guthrie. (John Wiley & Sons, New York; Chapman & Hall, London), 1939. Third Edition. Pp. 195. Price 9*sh. net.*

This edition has been fully revised in the light of the authors' experience in teaching. There are two important additions, a chapter on vertebrate development and another on Heredity and Variation. There is a substantial increase in the number of figures.

The method adopted in this book has been evolved after forty years of teaching in the University of Missouri. To begin with, the student is made to study in great detail the anatomy and physiology of the frog and further suitable directions are given to him to extend to other animals and to see for himself the principles recognised in the frog. This method helps the student to have a first-hand knowledge of the animals he is studying and enables him to understand thoroughly what he reads in text-books and learns in a lecture class. There are also chapters on general principles of zoology. In the Appendix are given directions for the preparation and the use of common stains and reagents and instructions for physiological and other miscellaneous laboratory experiments. The object of the authors has been to impress on the mind of the student the zoological facts and principles by such methods as are most effective rather than to give the stereotyped survey of the animal types. This book fulfils the requirements of an excellent introductory course in zoology. The method followed in this book can be adopted with great profit in the Indian Universities.

A. S. R.

A Laboratory Manual of Vertebrate Embryology. By F. B. Adamstone and W. Shumway. (John Wiley & Sons, New York; Chapman & Hall, London), 1939, Pp. 87. Price 7/6.

This book deals with the anatomy of selected embryos of the Frog, Chick and Pig. The laboratory course consists of the study of the serial sections and injected whole mounts of important stages of embryos. Directions and drawings of sections are given with the help of which the student is enabled to identify and study the different parts of the embryo. Spaces are provided in the manual for recording the observations of the student and making sketches of representative sections and further he is directed to label all unnamed structures in the text-figures. The directions are clear and instructive. This course enables the student to grasp the fundamentals of vertebrate embryology. We have great pleasure in recommending this book to every student of Zoology.

A. S. R.

BURIED EMPIRES

Buried Empires: The Earliest Civilizations of the Middle East. By Patrick Carleton. (Edward Arnold & Co., London), 1939. Pp. 290. Price 10*s.* 6*d.*

IT may be considered a form of prejudice, but I always feel that I am "put off" a book when I find that the author is guilty of inaccuracy in foreign words, spelling of names and the like.

I do not think I have ever met a book, purported to be a scientific treatise, so full of systematic mis-spellings. Almost every single Indian word is wrongly spelt; and, what is more, there is the affectation of preciseness by putting on Indian vowels diacritic accents, invariably on the wrong letter. Here are a few cases of Indian words misspelt: Shîva (instead of Shiva); Vâruna (instead of Varuna); Agni (instead of Agni); Sûryâ (instead of Sûrya).

He would write Panjâb (quite correct, but never used in modern geographical terms) and even Karâchi (more correctly: Karâchî, but again length-marks unnecessary in modern names); but on the other hand he will write Fars and Karman (instead of Fârs and Kermân). He writes Khûzistan (correct would be Khûzistân) and Kurdistan (instead of Kurdistân); and he writes Baghdâd (everyone writes the word without accent; but if you want to show the length-marks, you *must* write Bâghdâd, with accents on both vowels). He ought to know, for he has been in the East and did digging there; presumably, he has Arabic, without which he could not talk to his labourers. But Mr. Carleton was Woolley's assistant, as the book-jacket declares; yet Mr. Carleton refers to his own boss every time as Sir Charles Woolley. He

might have discovered that the name was Sir Leonard Woolley.

Now you will not convince me that a man who plays such havock with words can be accurate and precise. Mr. Carleton, who, as I shall mention later, has collected a creditable amount of materials, is guilty of further inaccuracy too. On page 56, after having carefully stated, and most correctly, our ignorance on a subject, he exclaims: "But there can be no certainty in the matter until much—very much—more evidence is brought to hand." This happens to be one of those unnecessary and ponderous overstatements that irritate the reviewer. The fact is that not much, not very much, but exceedingly little fresh evidence, provided it was good, solid evidence, would be quite sufficient in the matter: for instance a nice little inscription would completely suffice for me, thank you.

On page 73 he writes: "The Sumerians were most determined polytheists, and a complete list of merely the names of their different gods would fill a book." There is a neat little exaggeration for you. No doubt the Sumerians were "determined" polytheists (a charming Irish way of putting it), but their names alone would fill only a few pages, not a book.

But Mr. Carleton's mistakes would fill, almost, a small book. His Greek must be shaky, for he writes Istanbūl (it comes from Greek *polis*, and the correct spelling is with a short *u*, not a long one); his French *répoussé* has one more accent than necessary; he spells Brahma (or, if you wish, in modern Hindi: Brahm) as Brām, the river Rāvī he writes with a short i; and he makes Larkāna (Sindh) every time into Nārkāna.

On page 138 we read: "At the present day, *all* the languages of Europe, save for Basque, Turkish and Maltese, belong to the Indogermanic family." (The word *all* is printed in Italics in the original.) This leaves out about 25 million non-Indogermanic people. There are the Hungarians (about 16 millions), the Finns (about 4 millions), the Estonians, the Lapps, the Ural tribes (Ostyaks, Zyryens, Votyaks, Cheremis, etc.) all speaking the Ural-Altaian tongues which he completely forgot.

His little exaggerations are characterized by the title of the book. To speak of "Buried Empires" where well over two-thirds of the book deal with petty city-states, with probably only a few thousand inhabitants, is typical of the whole book. It is true that a few rulers obtained larger suzerainty during the period under his discussion, and a few of them, no doubt, could justly be called Kings; perhaps the largest domain may well have covered the area of present Iraq. On page 99, recounting the boasting text of Eannatum, the author says: "The conquests claimed by this formidable prince are very extensive." A detailed examination of a map would prove that most of his conquests were small cities twenty to forty miles away from his own; an excursion to about one hundred miles is only vaguely possible; but of an effective hold on even as large a country as, say, an Indian province, is more than doubtful.

But with all these exaggerations, Mr. Carleton's book contains much useful material. It is the more regrettable that a man of his reading and his ability for fortunate expression should have allowed himself to be carried away by oratory. Why call a piece of goldwork, however successfully done, "unquestionably the finest example of ancient goldwork in the world"? I have seen the original and I can show the author a number of other pieces of equal workmanship.

I liked the division and arrangement of the subject. After an introductory chapter of great use, we have the earliest remains from Susa, al-'Ubaid, Jemdet Nasr, etc., followed by a good account of Sumer and Akkad. The merely historical materials are well dished up alongside with garnishings of archæology and art history (though at the latter the author has an untrained eye). Some of Mr. Carleton's theories are unorthodox, which is not, by any means, a fault, but they should be justified. Such, among others, is his idea that the original inhabitants of Sumer belonged to the Armenoid race: a hypothesis no one, to my knowledge, holds to-day (pp. 86–87). His chronology, at the time of writing the book, was not far out of date; but he, most commendably, revokes all his datings in an appendix dealing with the discoveries at Mari. As is also known, practically not a single date originally suggested by Sir Leonard Woolley is now accepted.

From our Indian point of view particular interest attaches to the chapter called "The Cities of the Indus" (pp. 137–66). These chapters are now out of date. The author

read Sir John Marshall's and Mackay's *Mohenjo-daro and the Indus Civilization* and Dr. Mackay's smaller book, *The Indus Civilization,* to both of which he gives handsome praise, though I would like to mention that he entirely underestimates Dr. Mackay's rôle in these excavations. But Mr. Carleton has not read Mackay's wonderful publication in two large tomes, and, evidently, he has not read any of those numerous articles written on the subject and published in various periodicals. The more it is to his credit that his dating of this culture is, according to latest estimates, still correct. On the whole, considering his reading matter, Mr. Carleton gives a fair account of the Mohenjo-daro finds up to 1930 or so. There is much that could be corrected in the light of recent discoveries, but one glaring misunderstanding needs special mention. This is contained in the sentence on page 157: "There seems, at least, to have been no very glaring contrast between the status of different classes." Surely, exactly the opposite is true. The Mohenjo-darians, as anthropological examination proved, belonged to a number of races; there can be little doubt that there was an upper, ruling class, whose culture and standard of life was vastly superior to that of the lower classes. The latter must have lived a life of practical slavery. A number of pictographs actually depict slaves. There is a huge gap, of, say, a thousand years' development, between the sculpture of the upper classes, exquisite, refined, expensive, discriminate, on the one hand, and the perfectly archaic, primitive, barbarous pottery figurines of the lower classes, on the other. Whereas the rich wore bead necklaces made of semi-precious stones and gold and silver and faience, the poor had to be satisfied with pottery beads; instead of bangles made of copper, bronze, silver, gold and stones, the poor wore imitations made of clay. Whereas the upper classes, it appears, used copper for their utensils, this metal was then still too expensive for the poor who continued to use stone implements. Finally, a constant rebuilding of the city, after every flood, cannot be understood unless we postulate the existence of cheap or free labour. In fact, everything points to a tremendous gap between the culture of the upper classes and that of the lower ones.

I would not like to leave the reader with the impression that this is a miserable book; for it is nothing of the kind. It is a well-written popular summary of much of our knowledge of the Near and Middle East (though Persian archæology is neglected). It is a less reliable volume than Gordon Childe's *New Light on the Most Ancient East,* though more popular and covering a smaller area; but it is a thoroughly readable account for a layman of the history of ancient Mesopotamia and India from *c.* 3500 to *c.* 800 B.C., as revealed by recent discoveries in the field.

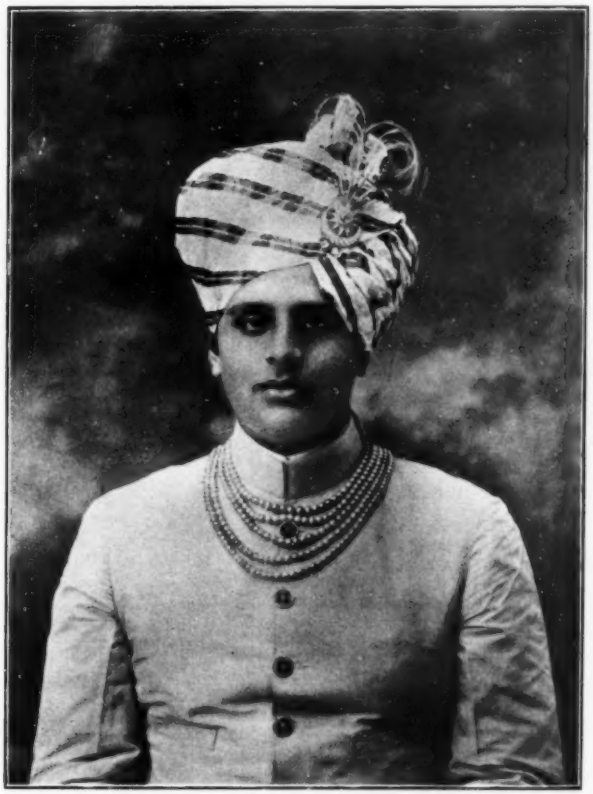
But my most serious grievance against this book is in the matter of illustrations. There are two excellent maps at the end, and a few really good illustrations; but, oh, how few! The publishers must realize that you cannot talk all the time about antiquities and not show them. Line drawings, used as text-illustrations, are better than nothing; pottery, metal objects, foundation plans and the like, can be shown really very well in text-illustrations which are very cheap; sculpture and the like can be given a few well-chosen plates. Here a little wisdom is necessary. There is, *e.g.*, opposite page 62, a plate containing two almost entirely identical photographs of one and the same object: truly, the height of foolishness! And why show the skeletons from Mohenjo-daro when it says so little of its culture? Would it not have been wiser to have a plate containing ten to twelve specimens of various seals from Iraq and India? With a little thinking many of the illustrations could have been made smaller and implemented by other, equally important pictures: for, after all, this is a book based on objects found in excavations.

To sum up: this is, no doubt, a well-intended book, with many good points, extremely readable, and suitable as a first introduction to the subject; with some critical trimming here and there, and with the addition of a number of fresh illustrations it could be made into an outstanding manual of really great value.

C. L. FABRI.

HIS HIGHNESS MAHARAJA

SRI JAYA CHAMARAJA WADIYAR BAHADUR



THE tidings that the Crown Representative has invested His Highness Yuvaraja Sri Jaya Chamaraja Wadiyar Bahadur with full ruling powers as successor to His late Highness Sri Krishnaraja Wadiyar Bahadur have been received in Mysore with universal rejoicing, and welcomed throughout India by Princes and people. The auspicious ceremony of formally installing the young Maharaja on the Throne of Mysore has been fixed for the 8th of September. We beg to tender our homage of respectful felicitations to the young Maharaja, and pray that Providence may bless him with long life and a happy and prosperous career.

THE ROYAL BOTANIC GARDEN, CALCUTTA*

THE Royal Botanic Garden, Calcutta, situated on the bank of the river Hooghly and only a few miles from Calcutta—the second city of the Empire, offers remarkable parallel to the Royal Botanic Garden, Kew, which is situated on the bank of the river Thames and is only a few miles from London—the first city of the Empire. But the Royal Botanic Garden, Calcutta, has a little different origin from its sister garden—the Royal Botanic Garden, Kew, which owes its origin to the interest in botany of royalty. The Royal Botanic Garden, Calcutta, on the other hand, like many other overseas botanic gardens was founded with economic and scientific aims.

Col. Robert Kyd of the Bengal Infantry, the then Superintendent of the Hon'ble Company's

COL. ROBERT KYD

Honorary Superintendent of the Hon'ble The East India Company's Botanical Gardens at Calcutta, 1786-1793

dockyard and Secretary to the Military Board of Fort William, a keen horticulturist, suggested on the 1st January, 1786, to the Governor-General to form a botanic garden in Calcutta. Without delay the present site, then measuring about 310 acres immediately below Kyd's private gardens, was acquired and the work of developing this area into a botanic garden commenced with Kyd's valuable collection of exotic plants. Kyd was appointed as the Honorary Superintendent of the Garden. When the East India Company dissolved, all the rights, duties and privileges were assumed by the Crown and the Garden became Her Majesty's Botanic Garden. The epithet 'Royal' came to be applied to it after the Queen's Proclamation of 1857. Kyd continued to perform the duties as Superintendent until his death in 1793.

Dr. William Roxburgh, the Company's Botanist in Madras, was appointed as the first official Superintendent in 1794. Roxburgh was the first to draw up a catalogue of 3,500 plants then growing in the Garden. Roxburgh's works —*Hortus Bengalensis, Flora Indica, Plantæ Coromandelinæ*—fully entitle him to the title of "the father of Indian Botany". Roxburgh died in 1815. H. T. Colebrook, Dr. Francis Hamilton (afterwards Sir Buchanon Hamilton), Nathaniel Wallich, James Hare, Thomas Carey successively held charge of the Garden from 1813 to 1816.

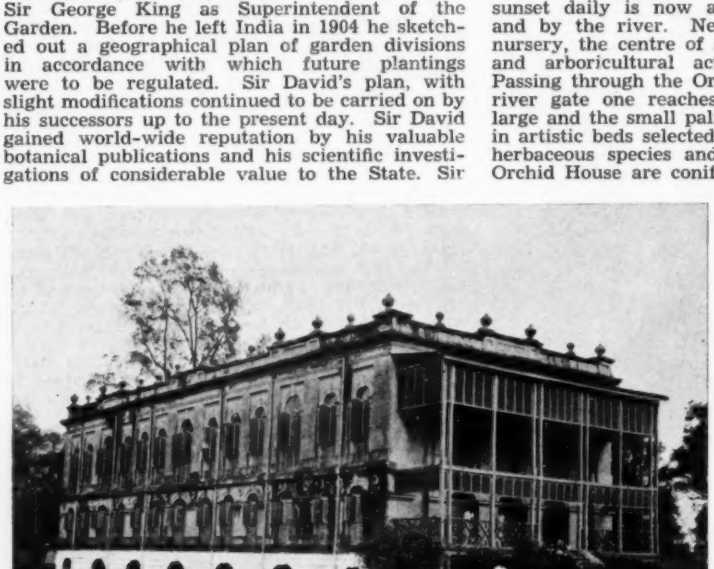
In 1817, Nathaniel Wallich was appointed and held office until 1846. At his time the eastern portion of the garden measuring 40 acres was given up by Government to the Lord Bishop of Calcutta as the site for a Christian College, which since 1880 is known as the Bengal Engineering College, Sibpur. In 1836 about 2 acres of land were allotted to the Agricultural and Horticultural Society of India where the Society in co-operation with the Garden officers conducted the greater part of its operation till 1872, when the Society's garden was transferred to its present site in Alipur. Dr. N. Wallich undertook an expensive survey of a large part of the Indian Empire; his enormous collections were catalogued and named in Europe by himself with the help of other botanists. A more or less complete set of this valuable collection is still in the Calcutta Herbarium together with his voluminous irreplaceable catalogue and his correspondence from 1794 to 1829. Dr. Wallich retired after 30 years of service in 1846 and died in 1854. During Wallich's absence on leave Dr. W. Griffith officiated and while on botanical expedition in Malaya died in Malacca in 1845. Dr. Griffith suggested many improvements of this garden, herbarium and the library which were subsequently followed by Dr. King to a certain extent. Dr. Wallich was followed by Hugh Falconer, who held office till 1855. From 1855 to 1871 Dr. Thomas Thomson, the joint author of the *Flora Indica*, Dr. T. Anderson and Mr. C. B. Clarke held charge of the Garden.

In 1864 occurred the great cyclone of Calcutta. It was accompanied by a storm wave from the river Hooghly that laid the greater part of the Garden under water. Over a thousand trees, at least one half of the total number in the Garden and innumerable shrubs were prostrated. Three years later a less severe but still very destructive cyclone completed the ruin. In 1871 Dr. (Afterwards Sir) George King took charge of the Garden, which was in a most unpromising state; and Sir George set to remaking of the Garden. It was due to his efforts that numerous wide roads were made all through the garden, valuable collection of dried plants were suitably housed in a handsome building, new propagating houses, tool and plotting-sheds and good dwelling houses for the members of the Garden establishment,

* Abstract of a lecture delivered by Dr. K. Biswas, M.A., D.Sc. (Edin.), F.R.S.E., at the Indian Museum, Calcutta, on 15th March, 1940.

were erected. King made enormous and remarkable contributions towards Indian Botany and initiated the publication of the world famous *Annals of the Royal Botanic Garden, Calcutta*, in 1887. The Botanical Survey Department of the Government of India, the oldest of the Surveys, was established at this time with Sir George's effort and the publication of the *Records of the Botanical Survey of India* was initiated in 1892 when the first volume of the publication appeared. Sir George King retired in 1897 after 26 years of meritorious service.

Lt.-Col. (now Sir) David Prain succeeded Sir George King as Superintendent of the Garden. Before he left India in 1904 he sketched out a geographical plan of garden divisions in accordance with which future plantings were to be regulated. Sir David's plan, with slight modifications continued to be carried on by his successors up to the present day. Sir David gained world-wide reputation by his valuable botanical publications and his scientific investigations of considerable value to the State. Sir David who is now about 85 is still actively engaged in botanical work.



Herbarium Building: Royal Botanic Garden, Calcutta

Lt.-Col. A. T. Gage, first appointed as Curator of the Herbarium, succeeded Sir David in 1906. A catalogue of non-herbaceous phanerogams cultivated in the Royal Botanic Garden, Calcutta, prepared during his time was published with the object of facilitating the exchange of plants, seeds, etc., with other botanical institutions. In 1908 during his absence on leave, Mr. W. W. Smith, (now Sir W. W. Smith, Regius Keeper, Royal Botanic Garden, Edinburgh), officiated as the Superintendent of the Garden. Lt.-Col. Gage retired in 1923 and was succeeded by Mr. C. C. Calder. Mr. Calder retired in December last year and has been succeeded by Dr. Biswas, the present incumbent.

In the open garden there are about 15,000 trees and shrubs. In addition to these there are several thousand herbaceous species in the palm-houses, orchid-houses and ferneries. The scheme adopted 34 years ago was to treat the garden as a map of the world on Mercator's projection representing the tropical floras. The plants of India and Burma are to occupy the central triangular area of the large western part of the Garden, this area being again subdivided in accordance with the geographical subdivisions of the Indian Empire. Scattered throughout the Garden are 26 irregular lakes, some of which are of large extent with islands. Altogether the lakes comprise about one-ninth of the total area of the Garden.

The Garden which is open from sunrise to sunset daily is now accessible both by roads and by the river. Near the river-gate is the nursery, the centre of all kinds of horticultural and arboricultural activities of the Garden. Passing through the Oreodoxa Avenue from the river gate one reaches the Orchid House, the large and the small palm houses where are kept in artistic beds selected ornamental and delicate herbaceous species and rare palms. Near the Orchid House are conifer group adjacent to the flower garden and the palmatum. Within close range of the palmatum are Mahogeny and Albizzia avenues. To the right of the Mahogeny avenue lies the Bambusetum. Near this area are also visible the fibre plants—Agave four-croydes—which flower once in their life and then gradually die like many of the bamboos.

From the river gate runs the Banyan avenue and a visitor can reach the great Banyan after five minutes' walk from the river gate. The great Banyan is now 171 years old. The crown is 1,100 ft. in circumference and there are about 666 aerial roots. In 1895 the girth of the main trunk was 51 ft. The tree suffered to a certain extent during the cyclones of 1864 and 1867 and some of its main branches were broken and thus exposed the tree to the attack of a hard fungus. The trunk thus decayed by fungus and subsequent attack of insects had to be removed some time after 1920. Series of major operations were performed and by grafting a daughter tree fresh energy has been infused. Attempts are now being made to extend the branches across the road round the Banyan circle like a canopy overhead. The tree is flourishing quite well.

The Herbarium

The Herbarium and the Library developed since the foundation of the Garden in 1786. The present damp-proof and fire-proof building, especially designed to house nearly two and a half million authentic sheets of Herbarium

specimens which form the basis of all botanical and allied investigations, was erected in 1883. In this Herbarium all these precious sheets consisting of irreplaceable types, cotypes, ecotypes, etc., are arranged in proper scientific order. The Herbarium is thus the depository of a very complete collection of the dried materials of plants of the whole of the Indian Empire as also fair collection of those of Asia outside India, of Europe, and Australia, Africa and America. This is the only place for botanical investigation of its kind in India and is recognised as the National Herbarium not only in India but also in the East by the International botanical organisations of the world.

Introduction in India of Quinine, rubber, ipecacuanha, various timber trees, fibre and oil-yielding plants and other plants of great economic value is mainly due to exploration by the scientific officers of this Garden. Various other useful plants, such as jute, tea, potatoes, coffee, sugarcane, flax, rhea, singal hemp, tobacco, coffee, cocca, rubber, indigo, fodder grasses, were introduced through this Garden. Almost all the road-side trees and ornamental garden plants now found widely grown all over India and Burma were first acclimatised in this Garden. They were then distributed all over India and abroad. Of recent introduction is the tung oil tree which is a source of considerable revenue in China. Experiments at this Garden indicate possibilities of cultivation of tung-oil in suitable areas of Bengal, Assam, Bihar, Mysore and North Burma. In Bengal the drier lower ranges of the Himalayas between 2,000 to 5,000 ft. is likely to prove suitable for cultivation of tung-oil tree. Reports of successful cultivation from Assam and some parts of Bihar are promising. Some ornamental and economic plants of recent introduction are *Victoria Curziana, Erythroxylon coca,* yellow lotus, *Musa rosacea, Cympogon Martinii, Aquiloria agollocha* (Aguru), *Durio zibethimus* and many others.

On the 6th January 1938, the 150th birthday anniversary of this Garden was held which happily coincided with the Silver Jubilee Session of the Indian Science Congress held in Calcutta. Encouraging messages and greetings from far and wide were received and many distinguished botanists took part in the celebration of the sesquicentenary of the Garden.

THE ELECTRIC DOUBLE LAYER*

SOME time ago, the *Faraday Society* considered that a symposium on Electric Double Layer would give rise to valuable discussion. Unfortunately, owing to the outbreak of war, it was not found possible to hold the discussion, but as many interesting contributions had already been received, the Society considered it desirable to publish them together in one volume. It is with the greatest interest that workers in Colloid Chemistry and allied branches of science, will study this monograph which contains a collection of contributions from almost all the prominent workers in the field.

The several contributions have been conveniently classified: Part I deals with experimental methods and results, and is subdivided into three groups of papers on electrophoresis, streaming effects and surface conduction, and electrocapillarity and other methods. Part II deals with the theoretical treatment of the Double Layer and its implications. Here electrokinetic equations, adsorption potentials and colloidal stability are the subjects of discussion. Part III deals with biological and technical applications.

In the introductory paper, E. K. Rideal (pp. 1–4) has discussed the various mechanisms of the formation of the electric double layer in colloidal systems. Abramson (pp. 5–15) has dealt with the potentialities of the Northrop-Kunitz cell and the Smith and Lisse apparatus for micro-cataphoresis and has discussed the application of the former to the elucidation of the changes in the number and orientation of the polar groups of organic ampholytes on adsorption. It has been shown how the asymmetry of the ampholyte ions could be calculated from electrokinetic data. Tiselius and Svensson (pp. 16–22) have studied the effect of salts on the electrophoretic mobility and the isoelectric point of egg albumin. The isoelectric point shifts towards the acid side as the ionic strength is lowered and is to be connected with the combination of ions other than H^+ and OH^- with the protein. The reduction in mobility caused by increasing ionic strength can be explained on the basis of the Debye-Huckel-Henry theory of electrophoresis. An interesting large-scale electrophoretic separator in which the substance to be separated flows as a thin layer between layers of electrolyte has been described by Philpot (pp. 38–46). Kerwick (pp. 47–52) has shown how the Lamm's scale method is used for the electrophoretic analysis of protein mixtures. The electrophoretic mobilities of dispersions of octadecane in presence of salts at constant pH, have been studied by Ham and Dean and they have discussed the results in relation to the thickness and the charge density of the double layer. Their results indicate that Guoy theory demands far too rapid a decrease in thickness of the electric double layer with increase in electrolyte concentration. When streaming potential measurements are made with many pure organic liquids through aluminium oxide and cellulose diaphragms (Gortner, pp. 63–68), interesting conclusions can be drawn regarding the orientation of adsorbed molecules at interfaces.

The importance of surface conductance in the calculation of ζ-potential has been brought out by Rutgers (pp. 69–80) and this is supported by his measurements of streaming potentials in

* *Transactions of the Faraday Society*, 1940, **36**, 1–322.

capillaries of different sizes. The anomalous behaviour of ζ-C curves for solutions of potassium chloride can now be adequately explained. Craxford (pp. 85–101) has critically surveyed the electrochemistry of simple interphases giving complete interpretation of the electrocapillary data obtained with mercury-solution interphases. According to Hartley and Roe (pp. 101–09) the problem of the electro-chemistry of micelles can be tackled from a new angle of view. It is possible to derive simple expression for concentrations of ions at the surface of a colloidal particle in terms of the ζ-potential. These theoretical considerations have been supported by the results obtained by a new line of experimental work, *viz.*, the determination of pH at the surface of micelles and in the bulk in paraffin-chain salt solutions. The importance of the ionic concentrations at interfaces in physico-chemical problems is pointed out. The potential ψ_0 defining the potential barrier for the accumulation of capillary active electrolytes and interfaces[1] has been identified with the ζ-potential. The reviewer would like to point out however, that ψ_0 cannot be identified with ζ. For ζ determines the work to be done to bring an ion to the mobile sheet of the electric double layer, whereas for stabilisation at the interface it would be necessary for the capillary-active ion to get into the plane sheet of the double layer. The transference of the capillary-active ion from the diffuse portion to the plane sheet is not a simple process; work would have to be done corresponding to Σ_{stern}. (*cf.* p. 112). So cataphoretic measurements would not be helpful to get an idea of ψ_0.

The second part of this symposium on the theoretical treatment of the double layer, starts off with an introductory paper by Kruyt and Overbeek (pp. 110–16) who have discussed a new and simple method of H. de Bruyn for the determination of ζ-potential. Among the other papers in this section may be mentioned the theoretical treatment by Hermans (pp. 133–39) of the relaxation effects in the electric double layer with special references to electrophoresis and the discussion on the significance of ζ by Guggenheim (pp. 139–43). Audubert (pp. 144–53) has dealt with the application of the Debye-Huckel theory to disperse systems; and Bikerman (pp. 154–60) has indicated how the surface conductance of capillary and colloidal systems necessitates an alteration of most electro-kinetic equations. The corrected equations account for the maximum of electrokinetic potential, the high dielectric constant of sols, and so on. Considerations based on surface conductance, moreover, render unambiguous the order of magnitude of the electrokinetic potential. Regarding adsorption potentials, Dean, Gatty and Ridea! (pp. 161–79) have expounded an interesting theory of adsorption potentials on the basis of which the results obtained on investigating the oil-water interfaces by a new technique have been explained.

According to Hamaker and Verwey (pp. 180–85) there is a general parallelism between the formation of deposits by electrophoresis and the formation of a sediment by gravity. Hamaker (pp. 186–91) has further discussed how the various forces involved in the sedimentation process depend on particle size. Derjaguin (pp. 203–14) has given a general theory of interaction of surfaces and applied it to the calculation of velocity of slow coagulation. By a new technique, he has brought evidence for the existence of long-range molecular forces acting over a distance of the order of $0{\cdot}1\,\mu$. The nature of the forces is obscure; they are not of the electrostatic, dipole or the van der Waals type. The reviewer is of opinion, however, that the whole phenomenon is connected with the irregularities of the surface of the solid against which the bubble is pressed. The retention of the liquid film appears to take place in the troughs at the surface and is presumably brought about by capillary forces. This idea is supported by the experiments of Derjaguin on hydrophobic surfaces (p. 214); no liquid can be retained by capillary action in hydrophobic cavities and hence this effect does not occur at surfaces coated with calcium stearate or paraffin. Levine and Dube (pp. 215–28) have discussed the stability proporties in hydrophobic sols. There is no particular upper limit or range of values to particle size in stable sols. According to Eilers and Korff (pp. 229–40), the assumption of a "critical potential" has no adequate foundation. The stability of the lyophobic colloid systems is determined by the energy required to bring together two particles of the dispersion against the action of their electric field. Experiments in which surface-inactive substances have been employed for stabilising the emulsions of amyl alcohol and water are described by Cheesman and King (pp. 241–47).

The phenomena of electric double layer formation and its effects find wide use in biological studies and in industry. According to Moyer (pp. 248–56) significant changes in electric mobility of certain bacteria are noticed with age of culture and the electrophoretic mobility of the latex particles is useful in characterising the different species of latex producing plants. The roll of electric double layer in virus stability has been discussed by Macfarlane (pp. 257–63). Other applications as in rubber technology, in wetting and flotation phenomena, and in electrodeposition of suspended solids, are described in a series of five papers. Finally Mattson and Wiklander (pp. 306–19) have discussed the simultaneous exchange of anions and cations at the equi-ionic point of sols which takes place in accordance with the Donnan equilibrium.

An attempt has been made in this review to present some of the broad ideas contained in the symposium number. The comprehensive monograph covering over three hundred pages of closely printed matter is undoubtedly a useful and up-to-date reference work to those engaged in colloidal and electrochemical investigations.

K. S. GURURAJA DOSS.

[1] Doss, *Kolloid. Z.*, 1939, **86**, 205.

CENTENARIES

Rickman, John (1771–1840)

JOHN RICKMAN, a British statistician, was born at Newburn, 22 August 1771. He graduated in 1792 from Lincoln College and conducted for some time the *Commercial, agricultural and manufacturer's magazine.* In 1796 he wrote a paper on taking of a census of the population.

First Census Act

This paper went to the notice of Charles Abbot, the Speaker, who took him as his secretary and employed him in preparing the first census act, introduced in December 1800. He was also chosen to examine and digest the census returns of 1801, 1811, 1821 and 1831. His introduction to the *Population returns* is remarkable for the very able analysis which it contains of the general condition, changes and prospects of all classes of the population.

He also wrote upon life annuities in the *Medical Gazette.*

A Species in One

"You must see Rickman to know him, for he is a species in one. A new class" wrote Lamb about him on November 3, 1800. He was popular in the literary circle of London. He was so careless in dress as to have been taken by the press-gang for a common tramp but was greatly respected by his friends for his shrewd sense and wide knowledge. He became an F.R.S. in 1815 and he was elected an honorary member of the French Society of Statistics.

Rickman died of an affection of the throat 11 August 1840.

Maury, Francis Fontain (1840–1879)

FRANCIS FONTAIN MAURY, an American surgeon, was born near Danville and spent his boyhood on the farm where Dr. Ephraim McDowell invented and practised ovariotomy. Having graduated B.A. in 1860 he entered the medical department of the University of Virginia the same year. He became a graduate in medicine in 1862 and began to work in the Philadelphia general hospital. His private practice grew with unusual rapidity.

Notable Feats in Surgery

Here are some of his notable feats in surgery:—

1. Ligation of the common carotid and subclavian arteries for aortic aneurism;
2. first gastrotomy for relief of syphilitic stricture of the esophagus;
3. the first resection of a portion of the brachial plexus to relieve the pain in neuroma of the skin of the upper extremity;
4. plastic operation for extrophy of the bladder, using the flap from the perineum and scrotum; and
5. the first successful amputation of the hip joint in America.

Maury has been characterised "as a cool, dextrous, cautious surgeon, of sound judgment". He died 4 June 1870.

Perrine, Henry (1797–1840)

HENRY PERRINE, an American plant explorer, was born at Cranbury, 5 August 1797. Till 1827 he practised medicine and thereafter he became United States Consul at Campeche, Mexico.

Botanical Collections

During ten years of continuous residence in Mexico, Perrine made botanical collections which enriched the herbarium of the New York Botanical Garden.

Plant Explorer

In 1827 President John Quincy Adams caused a circular letter to be sent to consular officers to procure foreign plants of known or probable utility for cultivation in the United States. Perrin took the request very seriously and began to flood the government with detailed reports on fibrous plants.

Victim to His Own Enthusiasm

In 1838 the government approved of Perrin's suggestion to establish a tropical plant introduction station in extreme southern Florida. Perrin was granted land for the purpose; and he removed to the place and spent two years tending and extending the nurseries. Of all the tropical plants introduced by him sisal is the most noteworthy.

Perrin died at the hands of marauding Indians 7 August 1840.

S. R. Ranganathan.
University Library,
Madras.

"A long record of successful achievement in medical research stands to India's credit, particularly in the field of tropical disease" says the Public Health Commissioner with the Government of India in his Preliminary Report for the year 1939.

"As early as 1877", he points out, "Vandyke Carter discovered the causative organism of relapsing fever. Later came the demonstration by Ronald Ross of the role of the anopheline mosquito in the transmission of malaria. The monumental work of the Indian Plague Commission established the fundamental facts on which our present preventive campaign against the disease is based. In regard to Kala-azar, the causative organism was discovered by workers in India and an effective treatment was also elaborated in this country, which has converted a 95 per cent. fatality rate into an equally high rate of recovery. The latest contribution of Indian workers to medical research has been in connection with the nature of the true cholera organism, and this work has received warm appreciation from the Cholera Commission of the International Public Health Office at Paris."

SCIENCE NOTES AND NEWS

A Remarkable New Fish from Bombay.—The last number of the *Records of the Indian Museum* (42, pp. 379–423, June 1940) contains an article by Mr. C. V. Kulkarni, "On the Systematic Position, Structural Modifications, Bionomics and Development of a remarkable new family of Cyprinodont Fishes from the province of Bombay". The new fish was discovered accidentally in the backwaters along the coast of the Bombay Presidency. As this discovery is likely to throw considerable light on the relationships and evolution of the Toothed-Carps, the very careful account of the fish by Mr. Kulkarni is of very special importance.

The most significant point about the new fish is the possession by the male of a massive and highly complicated organ for the transference to the body of the female in the neighbourhood of the genital opening of spermatophores, a structure discovered for the first time among fishes. Though a similar male organ for the transference of sperms is found among a variety of American Top Minnows, its occurrence in an allied Killifish of the Asiatic Continent has been discovered for the first time. It is worthy of note that the author has not confined himself to a mere taxonomic description of the species, but has given as detailed an account as possible of its morphology, bionomics and development. In these respects it is a unique paper in which a taxonomic account of great importance is accompanied by full details of the life-history and development of the species.

The paper is divided into four parts, Systematic Account, Structural Modifications, Bionomics and Embryology including larval development. In the first part, the author has given reasons for assigning this fish to a new family and has indicated its position among the Cyprinodont fishes by giving an outline classification of the Order after the latest scheme suggested by Hubbs and Myers. The diagnosis of the new family is given and the species is described in detail. In the second part, the structure of the gonopodium is described; it is a highly complicated organ and the author seems to have taken considerable pains in elucidating the relationships of its component parts; this portion of the work is extremely valuable. Mr. Kulkarni also directs attention to the asymmetrical position of the genital opening, the presence of the genital pads and the absence of the right pelvic fin in females. Each peculiarity is fully explained and suitable arguments offered for its utility.

The section dealing with Bionomics contains an account of the author's observations on mating, liberation of sperms from the spermatophores and laying of eggs; these observations are of a very high order and deserve special notice. In the embryological studies of the species the author has brought together a mass of valuable information. Special mention may, however, be made of the study of the development of the gonopodium and its ultimate differentiation into a complicated organ found in the adult males. A useful comprehensive bibliography is given at the end. The paper is well illustrated with neat and suitable diagrams.

S. L. HORA.

Indian Vegetable Oils as Lubricants in Internal Combustion Engines.—Lubricating oil for use in internal combustion engines is mostly of mineral origin and India has hitherto been importing practically all her supplies of this essential material from abroad. Since the outbreak of war, severe restrictions have been imposed on the import of these oils and the appearance of Bulletin No. 18 of the *Industrial Research Bureau* on the "Utilization of Indian Vegetable Oils as Lubricants for Internal Combustion Engines" by J. S. Aggarwal and Lal C. Verman, is therefore very timely. The authors describe the results of preliminary experiments carried out by them on three important Indian Vegetable Oils, castor, groundnut and cotton seed. The chief defect which has hitherto stood in the way of vegetable oils being used as lubricants for internal combustion engines is the comparative ease with which they undergo oxidation at the high temperatures they are subjected to in the engine. This oxidation results in increase of (1) viscosity, (2) acid value and (3) carbon residue; all these three factors interfering with the efficient working of the engine and leading to corrosion and other troubles. Accelerated oxidation test in the presence of iron according to a modification of the Air Ministry technique have been carried out and the increase in viscosity, acid value and carbon residue measured, both with and without stabilizers. The results show that castor oil is far superior to the other two oils. Some of the stabilizers tried such as α-naphthol and hydroquinone are fairly effective in minimizing oxidation, but even castor oil, using the best stabilizer, is very much inferior to the high grade mineral lubricating oils on the market. It is necessary, however, that a lot more of work should be done and the investigation can only be regarded as a preliminary one. The results of engine trials with stabilized vegetable oils are to form the subject-matter of future papers and they will be awaited with great interest as they will be the final criterion on which the value of these vegetable oils as lubricants can be judged.

C. V.

Phosphate Manuring on Lateritic Soils.—The peculiarity of the red lateritic soils on account of their very high content of iron and alumina and their consequent ability to render insoluble and therefore non-available phosphates existing naturally in the soil and that which may be applied in a soluble form as fertiliser, constitutes a difficult problem in judging the quantity and mode of application of phosphate manures on such soils. Their content of iron and alumina is so great that they can immobilise soluble phosphates running in to even a hundred tons per acre, compared with which

the ordinary doses of a few hundredweights applied in practice amount to almost nothing. How then can the difficulty be got over? Neither lime nor organic matter nor any chemical amendment can minimise the high phosphate fixing capacity of these soils. Resort has to be made to practices designed to favour the plant in procuring its phosphate supply without an undue proportion being fixed by the soil (N.H. Parbery, *Agr. Gaz. of New South Wales*, 51, Part 4). In this view the placement of the fertiliser in the course of manuring is of paramount importance to ensure that the roots will enter the zone of phosphate fixation early in their development and before fixation by the soil has proceeded far. Superphosphate is adapted for this purpose as it is in granular form and as its phosphate diffuses only slowly through the soil moisture and, if the placement is correct, into the radius of the absorbing roots themselves. Fertiliser in coarse granular form and application in close proximity to the spread of the absorbing roots are therefore recommended; the quantities, however, are not indicated but a regular yearly dressing of superphosphate will be necessary. We may add that a practical way of judging the dose has long ago been suggested by Wagner according to which the maximum dose beyond which there is no response to superphosphate is found by experiment and thereafter only the quantity removed in the form of crop and other plant material is supplied as the yearly dose of the fertiliser. The problem in all its aspects is of great importance to South India, in view of the predominantly lateritic nature of its soils.

A. K. Y.

Affinities of Symphyla.—A monograph of considerable importance throwing fresh light on the bearing of Symphyla (Myriapoda) on the question of the inter-relationship of the different orders of Arthropoda and especially on the origin of insects has been published by O. W. Tiegs (*Quart. Journ. Micros. Sci.*, 82, Pt. 1, 1–225). The author has studied the anatomy and embryology of *Hanseniella agilis* and has come to certain important conclusions regarding the affinities of the group (Symphyla) to which this animal belongs. The origin of both the Myriapoda and Insecta can be traced back to a Peripatus-like ancestor acquiring an increasingly perfect adaptation to life on land. The modification of the anterior segments and their incorporation in the head, the development of the Malpighian tubes from the hind gut, and the formation of eyes from groups of ocelli are all to be considered as attendant consequences of this land habit. From this protomyriapod ancestor was given off the Chilopoda which have a head simpler than in any existing myriapod or insect. The labium was a later addition and here arose the insects on the one hand and Diplopoda on the other. The insectan line is characterised by the development of a hexapod condition, the distinction between the thorax and abdomen, the development of compound eyes and the retention of the opisthogoneate condition. The specialisation along the diplopod line consisted in the production of diplosegments, the formation of the gnathochilarium by the fusion of the maxillæ and the labium, and the formation, secondarily, of an anterior reproductive aperture. The Symphyla probably originated at the point of bifurcation of the ancestral stock into Insecta and Diplopoda, with the important diplopod character, *viz.*, the progoneate condition, incorporated in it. The development of *Hanseniella* corroborates this view.

Age of Manganese Ores in Central Provinces.—Doubts which have for long been entertained as to whether the managanese ores occurring in the Chchindwara, Nagpur, Balaghat and Bhandara Districts of the Central Provinces are in the main of the same age or whether the Balaghat-Ukua deposits are younger than those found further west in the Chchindwara and Nagpur Districts, have been dispelled by a recent study made by Sir Lewis Fermor, late of the Geological Survey of India. Sir Lewis inclines to the view that the deposits are of the same age and is of opinion that the differences are probably due to the fact that rocks at the western end of the belt have undergone a severe metamorphism than those at the eastern end.

The results of the study are published in a memoir of the Geological Survey of India, which deals with Archæan rocks of Chchindwara, Nagpur, Balaghat and Bhandara Districts of the Central Provinces. This tract of Archæn rocks includes the most important manganese deposits of India.

Endemic Fluorosis.—The latest report of the Public Health Commissioner with the Government of India includes an account of the studies relating to fluorosis which was first reported in 1936. The disease is characterised by a definite train of symptoms such as stiffness and pain in the spinal region and in various joints. A detailed study of this condition was carried out by the Health authorities of that province and it was shown to be one of chronic fluorine intoxication resulting from the continued use of water containing fluorides.

The problem is two-fold, namely, the prevalence in a comparatively wide geographical area of a dental condition, commonly known as "mottled enamel", and the occurrence in a restricted area, of severe manifestations of chronic fluorine intoxication involving the spine, joints and ligaments to which the name of endemic fluorosis has been given.

The presence of fluorides in drinking water supplies has been demonstrated over a fairly wide area in Madras, although sufficient work has not yet been done to de-limit the fluoride areas in the province.

During 1939 detailed house-to-house surveys were carried out in certain areas to ascertain the incidence of the condition with special reference to the customs, dietetic habits, length of residence in the affected areas and occupation of the inhabitants. These surveys have yielded valuable results.

The survey revealed that even with a high fluoride content of the water used for drinking and cooking, the incidence and severity of chronic fluorine intoxication is greatly influenced for the better by a well-balanced diet; that even

with a comparatively lower fluorine content in the water, an insufficiency of vitamin C and a high calcium value in the diet results in a higher and more severe incidence of fluorine intoxication, even the younger adult age groups becoming affected; and that in the absence of fluorides in the water, these dietetic deficiencies produce neither mottling of enamel nor bone manifestations.

Laboratory experiments on monkeys have confirmed these findings of the field survey. Two factors therefore, appear to be important in the production of fluorine intoxication, *viz.*, the presence of fluorides in toxic doses and an unbalanced diet with a pronounced deficiency of vitamin C.

Research work in the removal of fluorides from water has been carried out at the King Institute, Guindy. No method has so far been evolved for removing these salts from natural waters at what may be considered a cheap cost. It would therefore, appear that the practical solution of the problem of endemic fluorosis should be sought by remedying the nutritional defects of the population.

Indian Ephedra.—The concentration of the active principle in the Indian ephedra is comparable with that in the Chinese ephedra, which till lately constituted the chief source of supply of this drug, according to investigations carried out in the Forest Research Institute, Dehra Dun. Publication of the results of these investigations has attracted the attention of the drug market of the world to India as a possible source of supply of this drug, which is a potent remedy for asthma and hay fever.

Indian ephedra is now being exported to the United Kingdom, but till 1938, export to the United States of America was almost negligible. In 1937, China exported ephedra to the extent of over two million lbs., of which the United States of America alone took 1,196,000 lbs. But in 1938, when supplies from China and Spain were reduced by wars in those countries, India exported to the United States of America 446,300 lbs. of the drug worth about Rs. 88,000.

If Indian ephedra is to establish herself in the American market—for which this is the right time—there must be a regular supply of the drug of uniformly high quality. This can only be ensured if the right species of the plant are collected from suitable localities and at the proper season. Failure to attend to these essentials in the past, stood in the way of India's getting a permanent foothold for her produce in the world markets.

Progress of Broadcasting in India.—The first Annual Report of the All-India Radio up to March 31, 1939, which has been recently issued, traces the development of broadcasting in India from a Radio Club at Madras in 1924 to a complex Government-controlled organization of seven stations and twelve transmitters, with a total income for nine years of over one crore rupees.

With the Bombay Station of the Indian Broadcasting Company which was opened in 1927 began the history of regular broadcasting in India. Then the number of licensed listeners was under 1,000, seventy-two times less than the number of licences in force in 1939. Gross licence fees in 1938–39 amounted to Rs. 7,50,261 and gross customs revenues to Rs. 13,70,320. Total programme transmission hours on the medium-wave rose to 16,670 and on the short-wave to 13,189.

With regard to radio programmes the All-India Radio has had to tackle, more directly than any other single institution, the problem arising out of a multiplicity of languages and complicated by a linguistic outlook of peculiar fluidity. Amidst a diversity of opinion, All-India Radio cannot hope to win universal approval in its linguistic efforts, but an attempt is made to proceed cautiously, though not illiberally, and to combine minimum diversity with maximum intelligibility.

It is yet too early to say how far the present educational policy of All-India Radio meets the requirements of the schools concerned. The object of school broadcasts is to supplement the work of the teacher, not to replace him. Widening the mental horizon of the students, and supplying such information and instruction as may be beyond the reach of the average institution ... these constitute the double objective of school programmes.

A special feature of the Report is the large amount of information of a technical and engineering nature which includes a full account of the important work of the Research Department on the measurement of atmospherics in India, a report on field strength measurements of medium-wave stations, and technical information on the short-wave service. There are also separate chapters on the technical features of the Lahore Broadcasting centre, the new All-India Radio transmitting equipment, the design of studios, the village receiver and the Todapur receiving centre.

Indian Central Cotton Committee.—The progress of work done to improve and develop the 'growing, marketing and manufacture of cotton in India' during the last year is recorded in the Annual Report of the Indian Central Cotton Committee. The Report gives in detail the various researches conducted under the auspices of the Committee in several laboratories and agricultural research institutions. Fundamental research on cotton genetics, physiology and agronomy has been carried out at the *Institute of Plant Industry, Indore*, and many interesting results have been obtained. The Official Testing House of Cotton at Matunga conducted several researches relating to cotton technology, the most interesting of which was the investigation on the absorption of dyes by Indian cottons. The results obtained under several research schemes, by the agricultural departments of the Provinces and States are also recorded in this Report. The success achieved in the seed distribution schemes and in the introduction of improved varieties of cotton is not very striking and it is to be hoped that the Committee will spare no effort to bridge the gap between the experimental station and the cultivator and effect the maximum improvement in agricultural practice in as short a period of time as possible. The incorporation

of Cotton Statistics and various Acts relating to cotton control, cotton transport, etc., makes this Annual Report invaluable to all those who are interested in cotton in some way or other.

P. S. S.

Researches at the Lac Research Institute, Namkum.—An important section of the work done at the Institute, has been the production of shellac moulding powders, states the annual report of the Institute for the year 1939–40.

The Institute has developed or adapted methods for the manufacture of urea and formalin in quantities sufficient for moderate-sized factories and work has been done with a new chemical which has the property of further improving the quality of shellac-moulded articles.

This substance, melamine, is easily prepared from calcium cyanamide which, though not manufactured in India, is available in large quantities, being one of the basic fertilisers. The use of much smaller quantities of this melamine than urea is an economic advantage as well, and it is expected that it will play an important part in shellac mouldings in future.

It is with the same idea of developing a moulding industry entirely based on indigenous raw materials that two other powders have been formulated; a shellac-casein and a shellac-coal-tar powder.

As a result of researches carried out at the Institute, it is stated, that shellac injection moulding, as distinct from compression moulding, promises a great future in the production of electro-technical goods. Already the Institute has been able to produce by this method electrical switches which can be sold much more cheaply than those made by compression moulding due to the higher rate of production and the simplicity of manufacture of the powder.

Research on Tuberculosis.—Consequent on a recent decision of the Central Committee, *The Tuberculosis Association of India* has paid a sum of Rs. 4,000 to *The Indian Research Fund Association* for an epidemiological enquiry on tuberculosis under Dr. R. G. Cochrane, Chief Medical Officer, Lady Willingdon Leper Settlement, Chingleput, Madras. The Tuberculosis Association of India is not in a position to undertake independent research work in tuberculosis, *at present*.

A tuberculosis survey is being carried out in Vayalpad by the authorities of the Union Mission Tuberculosis Sanatorium, Arogyavara near Madanapalle (Madras). Up to the end of May 1940 they had examined 2,000 persons out of whom more than 45 per cent. were found infected with tuberculosis. From these positive cases, strongly reacting cases were taken to the Sanatorium for X-ray and 48 were detected to be suffering from the disease.

Dr. L. Sibaiya, D.Sc., F.Inst.P., F.A.Sc.—We have pleasure in congratulating Dr. L. Sibaiya on the doctoral degree conferred on him by the Syndicate of the Madras University on the presentation of his published papers relating to *Hyperfine Structure of Spectral Lines* and *The Solid and the Liquid States*. Dr. Sibaiya's researches have received the highest compliments of the examiners to whom they were submitted, and it has been pointed out that the results obtained by him have an important bearing on the problems studied. He examined the structure of the spectral lines of elements such as mercury, copper, molybdenum, platinum, iridium, selenium, palladium, gold, germanium, rhodium, etc., for which he designed special types of water-cooled sources of radiation. Sufficient theoretical and empirical information regarding the nature and origin of hyperfine structure being then available, the isotopic constitution of platinum, gold and iridium was deduced from a study of the structure of their lines, the mass-spectrograph having till then failed to reveal the isotopic constitution of these elements. The conclusions regarding the isotopic constitution and the relative abundance of the isotopes in iridium have now been corroborated by Dempster's mass-spectrographic results. Significant results have been obtained from investigations on the self-reversal and Zeeman effect of hyperfine components. A review of the problems in hyperfine structure in relation to the isotopic constitution has been reported in the columns of *Curr. Sci.*, 1939, **8**, No. 10.

In the second part dealing with the solid and the liquid states, the data on the light-scattering in crystalline solids and on the magnetic investigations of liquids and their mixtures are discussed. Considering a liquid as an assemblage of monochromatic oscillators, significant relations between its molecular volume, viscosity, Raman frequencies, surface tension and compressibility are shown to follow.

Dr. S. K. Kulkarni Jatkar, D.Sc., F.I.I.Sc., F.I.C., F.Inst.P., was awarded the D.Sc. in Chemistry of the Bombay University at the recent convocation, for his thesis on "Specific Heats of Organic Vapours from Supersonic Velocity". He is the second person to obtain the D.Sc. in Chemistry from Bombay University, the first being Dr. A. N. Yajnik of Lahore.

The production of optical glass in America was started in 1917, at first as a war industry, by **Bausch and Lomb Optical Co.**, to supply the vital materials required for the pursuit of war and later on developed into a highly specialised national industry. A brief account of the development and manufacture of optical glass in America is given by M. Herbert Eisenhart and Everett W. Melson of this company in the *Scientific Monthly* (1940, 50, 323). The description includes a critical analysis of the exacting requirements of the optical glass of to-day. Great care taken in America in maintaining the purity of pots, the choice of the furnace, the composition of the batch, the mode of stirring and the process of annealing is clearly brought out.

In another useful paper entitled "Designing Corrected Lenses" by Walter Litten and issued by **Bausch and Lomb Optical Co.**, the various errors to be borne in mind in the design of photographic lenses such as spherical and chromatic aberrations, coma, astigmatism and distortion, are described in non-technical

language and remedies suggested. The development of colour photography in recent years has made the task of the lens-designer more difficult. However, the best design for monotone with panchromatic materials will also be the best design for natural colour photography. The modern trends in the design of photo-lenses are indicated.

C. S. VENKATESWARAN.

ASTRONOMICAL NOTES

The Sun enters sign Libra and is at the autumnal equinox at 10^h 16^m I.S.T. on September 23.

Planets during September 1940.—Venus reaches greatest apparent elongation west of the Sun (45° 57′) on September 5 and will continue to be a conspicuously bright object visible in the morning sky for over three hours before sunrise. Mercury is in superior conjunction with the Sun on September 4 and will not be in a favourable position for observation during the month. Likewise, Mars which has passed into the morning sky, will be too close to the Sun during the month and cannot be well observed.

Jupiter and Saturn which are apparently close to each other, rise at about 9 p.m. and are conveniently situated for observation in the latter part of the night. The former reaches a stationary point of its orbit on September 4 and begins to move westward among the stars. Saturn, about a degree and a half south of Jupiter, is also moving in the same direction. The brightness is increasing, the stellar magnitude being 0·3 in the middle of the month. The ring ellipse continues to widen and the angular dimensions of the major and minor axes are 43″·8 and 15″·3 respectively. On September 21 will occur close conjunctions of the Moon with these two planets. Uranus also is in the morning sky and will be on the meridian at about 4 a.m.

Variable Stars.—The well-known variable, χ Cygni is expected to reach maximum brightness about September 30, when it will be of the fourth magnitude and easily visible with the naked eye. The period of variation of the star is approximately 413 days and the range about 10 magnitudes, so that at minimum it can be seen only with a fairly large telescope. It is situated about midway between the two bright stars β and γ Cygni and can be readily identified. Another interesting variable, ρ Cygni —irregularly varying between magnitudes 3·5–6·0—will be found about two degrees south of the latter star.

T. P. B.

MAGNETIC NOTES

Magnetic conditions during July 1940 were comparatively less disturbed than those during the preceding month. There were 10 *quiet* days, 20 days of *small* disturbance, and 1 day of *moderate* disturbance as against 9 quiet days, 14 days of slight disturbance and 8 of moderate disturbance during the month of July 1939.

The most disturbed day in July 1940 was the 13th on which day a moderate magnetic disturbance was recorded. The quietest day during the month was the 17th. The characters for the individual days are shown below.

Quiet days	Disturbed days	
	Slight	Moderate
2, 7 8, 11, 12, 17–20, 23	1, 3–6, 9, 10, 14–16, 21–22, 24–31	13

There was one moderate storm during the month as against 5 moderate storms during July 1939. The mean character figure for the month is 0.71 while that for July of last year was 0·97.

M. R. RANGASWAMI.

SEISMOLOGICAL NOTES

During the month of July 1940, one slight and three moderate earthquakes were recorded by the Colaba seismographs as against two slight ones recorded during the same month in 1939. Details for July 1940 are given in the following table:—

Date		Intensity of the shock	Time of origin I. S. T. H.	M.	Epicentral distance from Bombay Miles	Co-ordinates of the epicentre (tentative)	Remarks
July	10	Moderate	11	20	3330	In or near Korea.	* Owing to strong microseisms the different phases of this shock could not be determined with sufficient accuracy from the Colaba seismograms. It was reported in the papers that 300 persons were killed, several hundred injured and 12 villages were destroyed.
	14	Moderate	11	23	5740	Near 52° N., 177° E. in the neighbourhood of Aleutian Islands.	
	21	Moderate	21	09	3470	7° N., 123° E. to the south of Mindanao Island.	
	30	Slight	05	42	2460	Probably Anatolia.*	

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